MODERN PLASTICS

E. F. LOUGEE, EDITOR • DR. G. M. KLINE, TECHNICAL EDITOR • C. A. BRESKIN, PUBLISHER

AUGUST 1939

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Cover Color this Month GREENJADE (Created by Textile Color Card Association)

SEPTEMBER

Turning out continuous sheets of transparent resin, cutting them to size and polishing their surfaces, is intricate business and the process usually is *very, very* secret. It is not often that we have a chance to show how it is done.

Three technicians of the Vinylite Division, National Carbon Co., Inc., however, got their heads together and have described a modern° Sheet Production Unit. The story, together with a photograph of the press polishing machine and a diagram of the complicated electrical controls, heads the list of informative articles in our September issue

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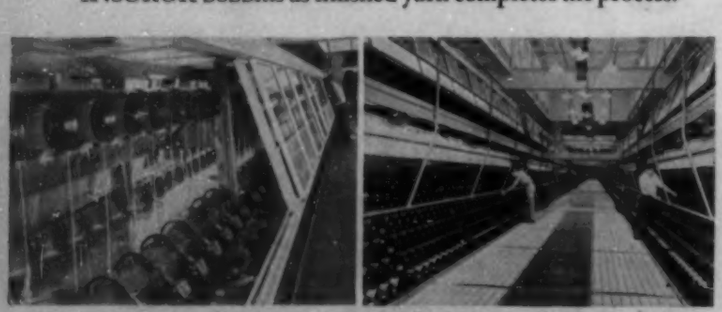
Portrait of a Builder of Industry

THIS ingenious chemical-resisting, thread-advancing plastic reel made possible continuous production of viscose rayon, one of the major developments in the age-old history of textiles. From the spin-bath, in which they are formed, rayon filaments travel over a succession of plastic reels through processing and cleansing . . . a journey of six minutes during which the rayon is subjected to various treating baths and washes. Winding on INSUROK bobbins as finished yarn completes the process.



Viscose is extruded through microscopic openings into a coagulating bath, forming almost invisible filaments. Here begins the processing journey. The rayon filaments, carried over the plastic thread advancing reels through various steps of treating and cleansing, are wound as finished rayon yarn on INSUROK bobbins.

For continuous rayon production to become a practical accomplishment, it was essential that plastic reels be impervious to the action of processing liquids . . . resist surface abrasion . . . remain constant in diameter . . . possess durability that would permit operation 24 hours a day, 365 days a year.

The one material capable of meeting these exacting requirements was a specially compounded plastic, precision molded by Richardson. Today ninety-six rayon spinning machines in the Industrial Rayon Corporation plant, each employing 900 plastic reels, attest to the share synthetic plastics play in the process modernization of rayon — itself a synthetic material.

INSUROK

The precision Richardson plastic, used in gears, seal rings and bobbins in rayon production, is available in sheets, rods and tubes, in grades, sizes and thicknesses for hundreds of widely diversified uses; for parts, finished products and manufacturing equipment. Somewhere in your product there is undoubtedly an application for INSUROK. Consult Richardson engineers about any plastics interest. Write the office nearest you.

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Melrose Park (Chicago) Illinois — Founded 1858 — Lockland (Cincinnati) Ohio
New Brunswick, N. J. — Indianapolis, Ind.
Detroit Office: 1172 G. M. Building, Plymouth 9-5800
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NOT YET 3 YEARS OLD...

BUT LOOK HOW "LUCITE" GETS AROUND!

IN SHEETS
it's being used for:

Airplane windshields
Boat windows
Book ends
Brush backs & handles
Carved figures
Cigarette boxes
Costume jewelry
Display fixtures
Draft gauges
Electric switch plates
Fishing reels
Furniture
Hand bag frames
Insulating bars
Loud speaker baffles
Machine guards
Machinery windows
Murals
Pipe racks
Transparent models
Trays

IN TUBES
it's being used for:

Beer tank gauges
Bus lighting
Cigarette lighters
Compacts
Costume jewelry
Decorative effects
Display fixtures
Elevator signal parts
Gauge guards
Milk dispensers
Models
Paper cup dispensers
Plating operations
Traffic directors

IN RODS
it's being used for:

Antennae separators
Batons
Canes
Carved figures
Clarinets
Decorative effects
Display fixtures
Door knobs
Ear pieces
Edge-lighted pointers
Edge-lighted signs
Furniture
Illuminated sign buttons
Insulating washers
Insulators
Magnifying lenses
Models
Optical lenses
Pen and pencil parts
Pipe stems
Railings
Surgical instruments
Swagger sticks

MOLDING POWDER
is being used for:

Applicators
Auto dashboard panels
Battery cases
Bus and truck reflectors
Cigarette lighter parts
Combs
Exterior auto fittings
Gas analyzers
Hearing aids
Highway reflectors
Indicator buttons
Interior auto fittings
Jewelry parts
Machinery windows
Magnifying lenses
Optical lenses
Pen and pencil parts
Phonograph parts
Pipe stems
Radio dials
Radio knobs
Saxophone mouthpieces
Selector buttons
Toy parts
Transparent containers
Typewriter key covers
Watch crystals

IT'S EASY to see why more and more manufacturers are using Du Pont "Lucite" methyl methacrylate resin. "Lucite" can be crystal-clear or beautifully colored. It's light in weight, easily worked, yet very strong. It "pipes" light. It's low in moisture absorption and high in dielectric strength. And "Lucite" withstands outdoor exposure.

Doesn't this suggest practical and profitable uses of "Lucite" in your products too? Keep abreast of new uses and information about "Lucite" and other Du Pont plastics by sending for your free copies of the newsy, timely *Plastics Bulletin*.

DU PONT
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PLASTICS

E. I. DU PONT DE NEMOURS & COMPANY, INC.
PLASTICS DEPARTMENT · ARLINGTON, N. J.

BY THE SKIN OF YOUR TEETH . .

We once boasted we could mold anything. But these are a molding job we lost out on—we've got to acknowledge nature and your dentist as our masters.

Still, here are a few unusual jobs we *have* done successfully.

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We also accomplish—often—2 *lb.* moldings.

100 lot orders are welcome here. 1,000,000 lot orders do not strain our reserve capacity.

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Established 1872. *Sole Producer of Celluloid and Lumarith.* (Trademarks Reg. U. S. Pat. Off.)

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When you think of plastics, think of headquarters — "the Granddaddy of them all" . . . and . . .

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Shaped In

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Our Business is Keeping Quiet

Perhaps you still remember those days way back when your automobile was apt to roll along the highway with birdies beneath its bonnet—chirps in its chassis—and assorted squeals in its body and springs.

Patiently and persistently top-flight automotive engineers traced down these sundry squeaks and squeals which so often were caused by vibration due to metal meeting metal at inopportune times and places.

That's where Inland comes into the picture. Eventually your squawks about squeaks were translated into a thousand problems for Inland's chemical and mechanical research engineers . . . problems fraught with the promise of a car which would tip-toe along hushed highways.

Myriad problems concerning the marriage of metal and rubber into a quiet, enduring union. Problems of developing new compounds, pioneering new designs, new formulas, new machines and methods.

Problems solved so successfully that, today, Inland economically produces under laboratory control of manufacture, hundreds of parts which cushion shock, insulate against the transmission of sound and smooth out vibration.

Today, two Inland plants employing over 3,600 people, produce more than 425 rubber, metal, plastic and associated products.

Today, Inland's research, design, engineering, management, equipment and resources serve more than a score of industries.

And we want you to know that our business is keeping quiet. We efficiently merge decibels and decimals for economical, large-volume production of rubber, metal and plastics which will help *your* product to serve (and sell) better.

INLAND *MANUFACTURING DIVISION,* **GENERAL MOTORS CORPORATION**
DAYTON, OHIO *RAHWAY, N. J.*

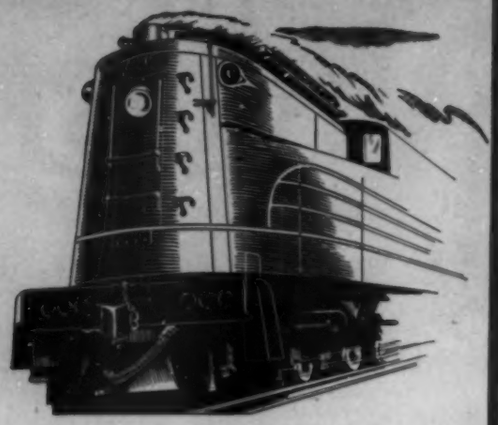
IF YOU HAVE A PROBLEM *PRODUCT, REMEMBER*

INLAND *WILL MAKE IT* { *STYLISH* / *QUIET, SAFE and* / *SHOCK INSULATED*

with Rubber, Metal and Plastics

INLAND

Reilly INDUR PLASTICS



...AND THE *Nation's Railroads*

In the construction of the General Railway Signal Company's control systems, installed all over the world, many important parts are molded of plastics—primarily for electrical insulation. Breaking or cracking of these parts in service would interfere with the successful automatic operation of relays and switches . . . Many different molding compounds were tried, but for certain parts, particularly those where metal is embedded, only REILLY INDUR was found entirely satisfactory—reducing manufacturing "rejects" to the minimum, and providing the dependability which is absolutely necessary for safety.

REILLY TAR & CHEMICAL CORPORATION

Executive Offices: Merchants Bank Building, Indianapolis, Indiana

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(cast phenolic resin)

o In this presentation of "The Clock of Tomorrow" by Empire Clock Company, MARBLETTE again manifests its superiorities—in color, beauty and structural design. o Staple products as well as "novel" items are given new life and greater sales appeal through the adaptation of MARBLETTE. o Surprisingly, too, are the many production economies gained. o Have our industrial design staff demonstrate on your particular new product development.

MARBLETTE is available in sheets, tubes, rods and special castings . . . hundreds of colors in translucent, opaque, clear and mottled tones.

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PHILCO CHOOSES "Vinylite" Plastic Sheets for Conservador Refrigerator Dial

AND with good reason, too, because these thermoplastic sheets do not warp, blush, or get sticky. The humid atmosphere within the refrigerator has no effect on them. Tests show that "Vinylite" resin sheets absorb only 0.05 per cent water during immersion in water for 24 hr. as compared with 1.5 per cent for other plastic sheets. Furthermore, they are non-toxic and do not impart any odor or taste to foods.

Just as exceptional resistance to water and moisture makes "Vinylite" plastic sheets ideal for refrigerator dials, this and the other unusual properties outlined at the right make these sheets preferred for many other uses. What they have done for others to improve product quality . . . to enhance appearance . . . to increase sales appeal . . . they can also do for you. Start now to put "Vinylite" resin sheets to work in your product. Send for a book of samples and let us help you with any application you have in mind, without obligation.

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Unit of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York, N. Y.
PRODUCERS OF SYNTHETIC ORGANIC CHEMICALS

Only "Vinylite" Resin Sheets Have All These Properties

1. They do not curl, blush, or get sticky—water and moisture do not affect them.
2. They are non-flammable and will not support combustion.
3. They are completely resistant to oil, grease, and alcohol, and highly resistant to practically all chemicals.
4. They are exceptionally strong, tough, and rigid even at below-freezing temperatures.
5. They are tasteless, odorless, and non-toxic.
6. They can be easily formed, drawn, and laminated under heat.
7. They do not warp or shrink on aging—no "seasoning" period is necessary.
8. They can be printed on in multiple colors with perfect register.
9. They have and maintain uniform properties in all thicknesses.

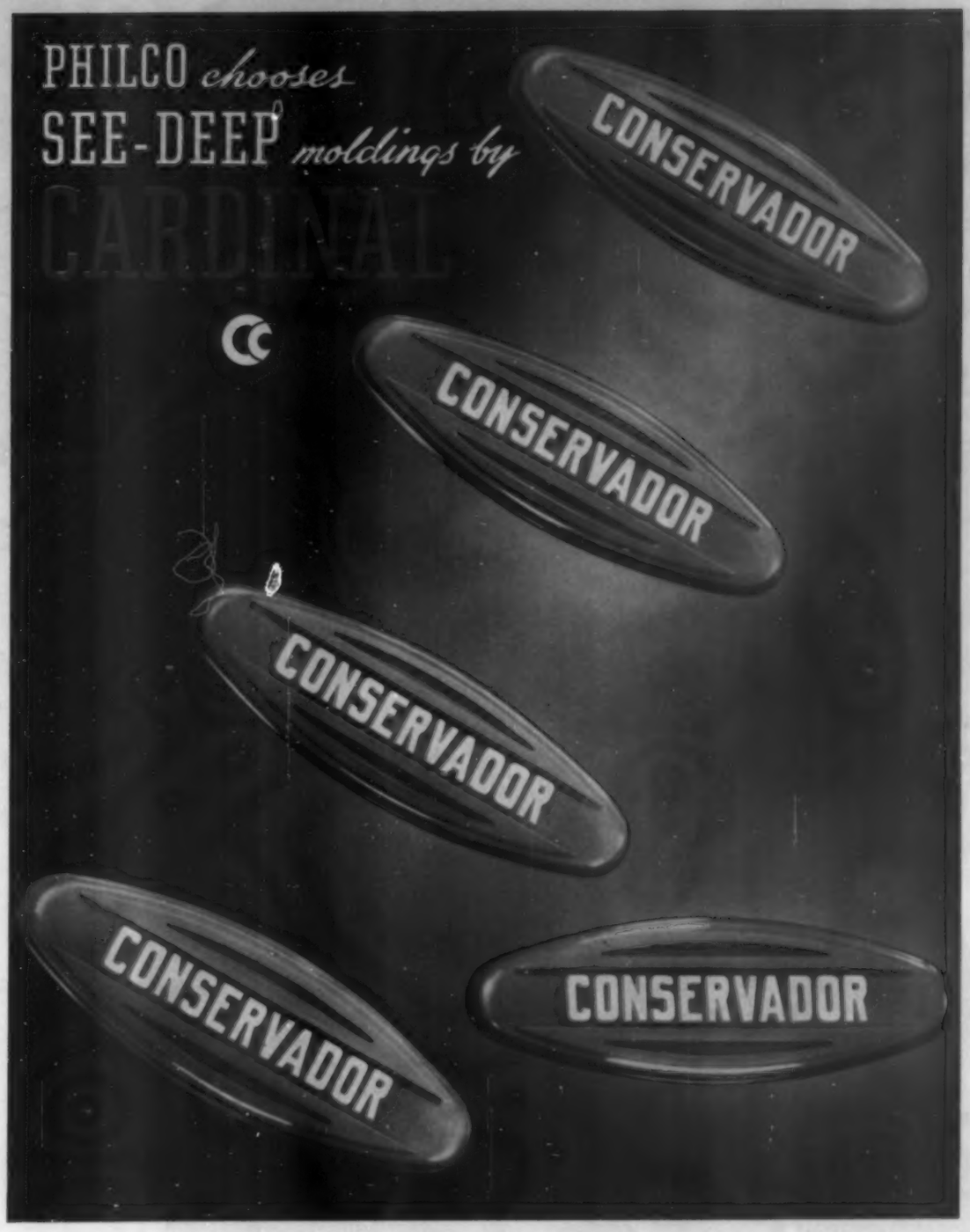
Sheets available in quantity, in a variety of colors, thicknesses, and finishes.

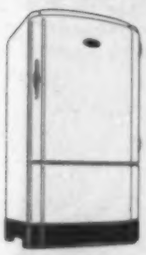
Vinylite Resins *plastics for many purposes*

TRADE MARK

The word "Vinylite" is a registered trade-mark of Carbide and Carbon Chemicals Corporation.

SHEETS . . . FILM . . . TUBES . . . RODS . . . EXTRUDED SHAPES . . . ADHESIVES
MOLDING POWDERS . . . SURFACE COATING RESINS . . . COATED PAPER





"SEE-DEEP" nameplates — made possible by Cardinal's unique "three-dimensional" process (patent pending) — accent the gleaming beauty of Philco's new Conservador Refrigerator. Crisp, white letters . . . standing in bold relief . . . against a cool, blue background . . . the whole covered with clear, transparent plastic. Produced by the Cardinal Corporation, Evansville, Indiana, molders of distinctive specialty-finished plastics.

CARDINAL

FORD New York WORLD'S FAIR EXHIBIT CONTAINS A

LESTER DESIGNED

I.M.C.
Fully Automatic

INDEX MACHINERY CORPORATION

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INJECTION MOLDING MACHINE

A battery of 7 Lester Designed Machines at the Rouge plant—an additional Lester Machine at the Ford Exposition at the New York World's Fair—offer striking evidence that I.M.C. Lester Designed Fully Automatic Injection Molding Machines meet the rigorous high standards the Ford Motor Company imposes in the selection of production equipment.

Index Machinery Corporation justly feels honored to have its Lester Designed equipment used by this great motor-car manufacturer in the production of molded parts for Ford-built cars.

Investigation may show you why I.M.C. Fully Automatic Injection Molding Machines with their standard capacities of 4, 6, 8 and 12 ounces; their exclusive performance features and economical operation can help make your molding operations more profitable. Write us for further details.

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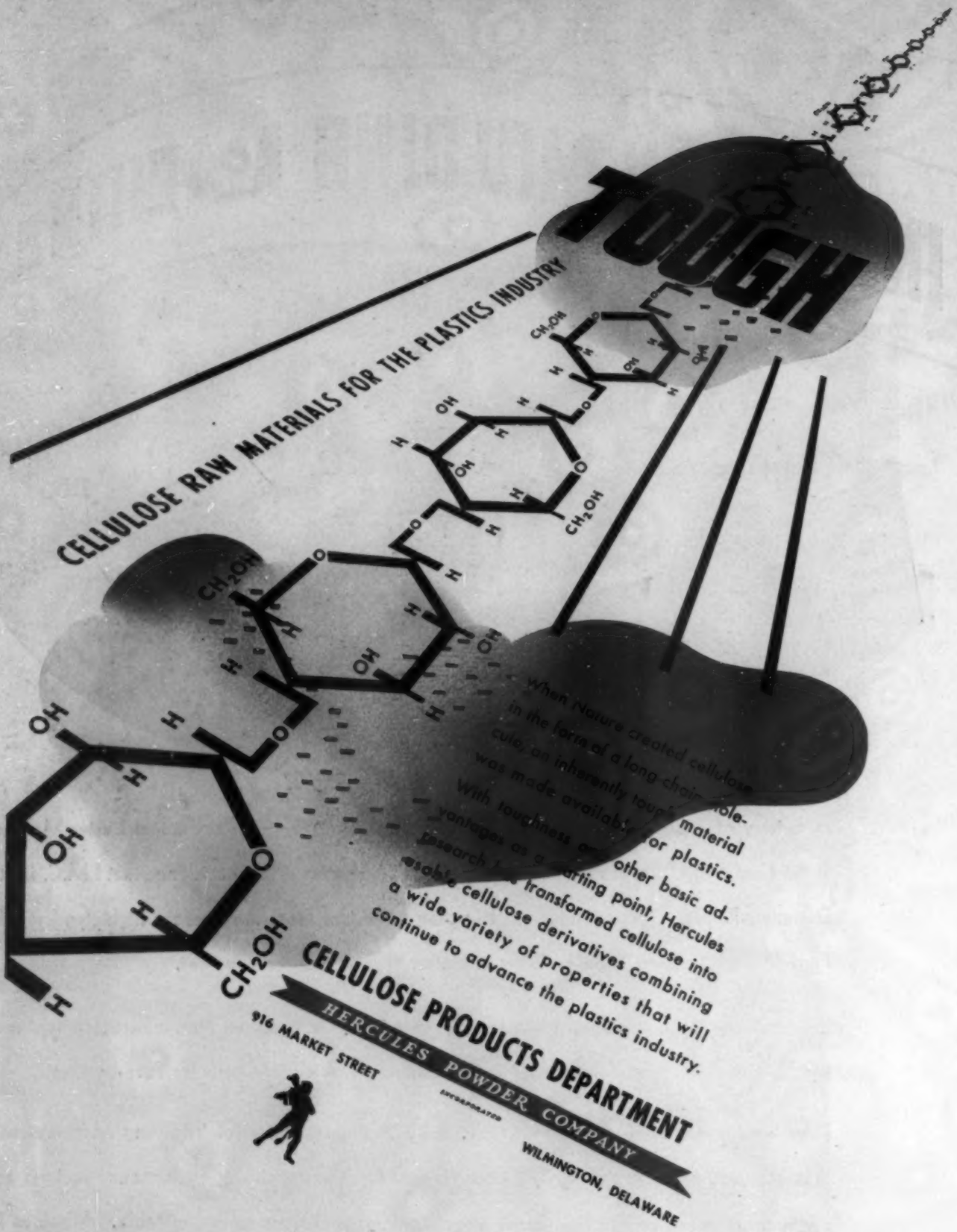
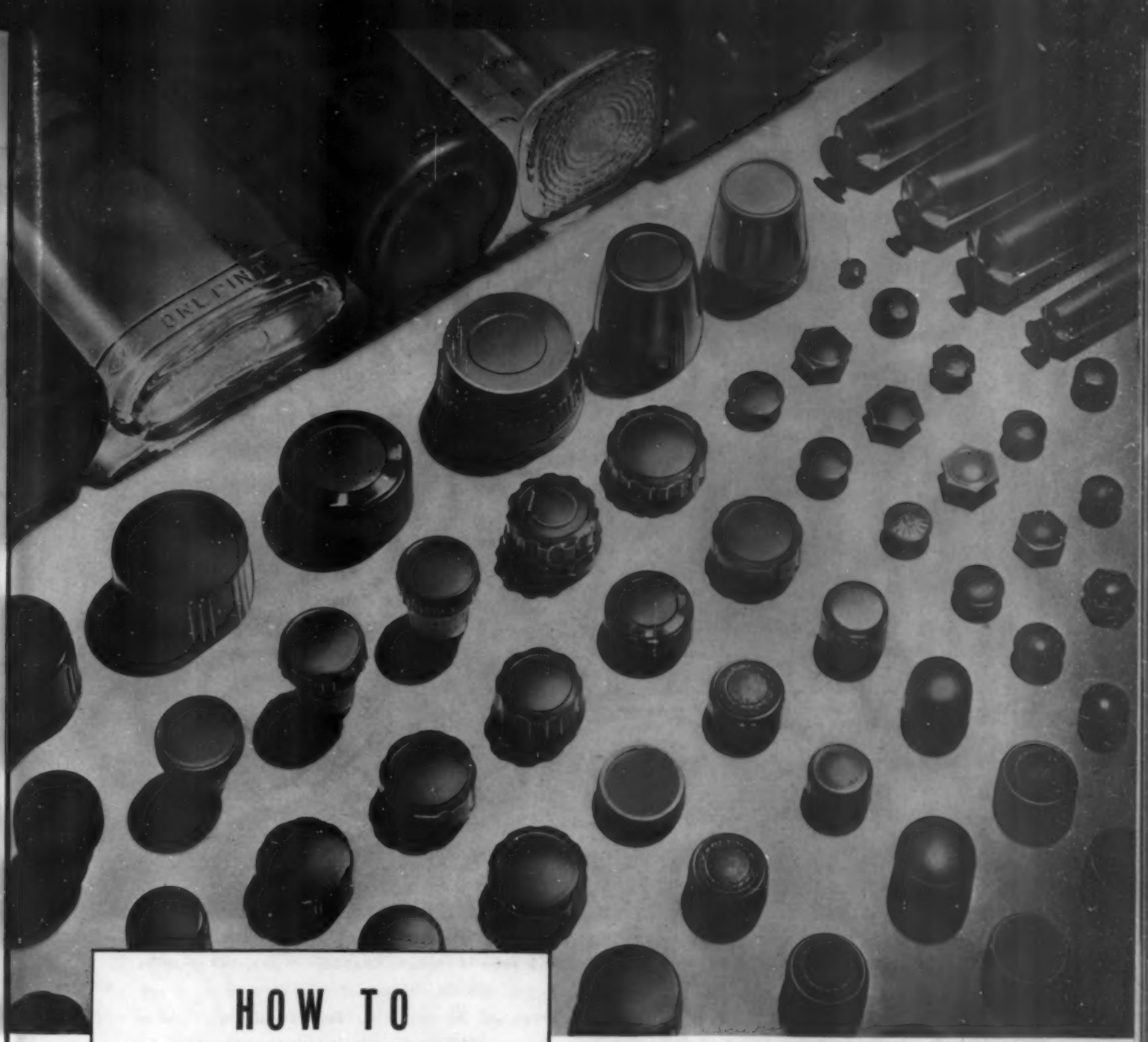


HERCULES NITROCELLULOSE • HERCULES CELLULOSE ACETATE • HERCULES ETHYL CELLULOSE

DDD 9



HOW TO MOLD YOUR PERSONALITY

INTO THE CONTAINER goes a product that has an individuality all its own—*that's why every man's business is different*. How to reflect that personality of the product and its maker, so that it will be self-evident to the consumer in the retail store?

To scores of manufacturers, molded closures of Resinox phenolic compound provide the answer. Product personality emerges from the molding presses, sharp and clean-cut, in the form of closures bearing distinctive patterns and designs, trade marks or product names.

Added to the *finish* that Resinox closures bring to the packaged product are these *plus* advantages: Ease of removal . . . added eye-appeal with a variety of colors . . . resistance to liquids and pastes with consequent freedom from rust or corrosion. Resinox molded closures do not require the application of finishing materials, since their finish goes all the way through and cannot be rubbed off or easily marred. Their high torque strength is resistant to the impact of automatic capping and bottling machinery.

Resinox phenolic compounds are one of the family of six Monsanto Plastics—covering a broad range of plastics applications. For complete information and names and addresses of plastics fabricators, inquire: Monsanto Chemical Company, Plastics Division, Springfield, Massachusetts. District Offices: New York, Chicago, Detroit, St. Louis, Los Angeles, Dayton, Montreal.

MONSANTO PLASTICS

Cellulose Acetate • Cellulose Nitrate • Cast Phenolic Resin • Vinyl Acetals • Polystyrene Resinox Phenolic Compounds • Sheets • Rods Tubes • Molding Compounds • Castings Vue-Pak Transparent Packaging Materials

MONSANTO PLASTICS

SERVING INDUSTRY . . . WHICH SERVES MANKIND

Beetle Laminated Makes Refrigerator History

The neat, sanitary appearance of the inner door will remain indefinitely. There is no surface enamel to chip or wear. Color is all through. Stains are easily removed with a cloth.

Beetle Laminated panels are fabricated in one simple "forming" operation. Assembly is quick and easy. They are simply attached to the door front by means of screws.

NEW PRODUCTION AND SALES ADVANTAGES GAINED BY ITS USE FOR DOOR PANELS

ONE of the world's best known and most scientifically designed refrigerators is now equipped with an inside door panel of Beetle* Laminated. The results are: thinner and simpler door construction, better insulation, lighter weight and greater resistance to scratch, chip and wear.

Because of the high insulating value of Beetle Laminated, the thickness of the entire door has been reduced from 3½ in. to 2⅛ in.—an inch of valuable space saved with an *increase* of thermal insulation. The remarkably light weight of this unusual material has taken considerable poundage off the refrigerator—and at a point where it is greatly appreciated by the user. Greater durability has been made possible by the tough, resilient surface of Beetle Laminated, which resists severe impacts and defies scratching and nicking. All of these advantages are powerful, convincing selling points for this smartly designed product.

Beetle Laminated is finding many new uses in a wide range of products. In addition to its special properties it also offers the advantage of color for a variety of new design and decorative ideas. Beetle's staff will be glad to give you assistance in using it with economy and profit.

BEETLE PRODUCTS DIVISION OF AMERICAN CYANAMID COMPANY
30 ROCKEFELLER PLAZA, NEW YORK, N. Y.

*Trade-Mark of American Cyanamid Company applied to urea products manufactured by it.

Beetle

IT'S ALL COLOR AND IN ALL COLORS

MODERN PLASTICS
AUGUST 1939 VOLUME 16 NUMBER 12

COURTESY, WASHINGTON INSTITUTE OF TECHNOLOGY

1890 versus 1939—The 2-lb. cast iron horse drawn carriage contributed nothing to the child's mental development; it was merely a shiny, eye-catching pull toy cherished for a time but soon forgotten. The 2-oz. prefabricated airplane, put together with the child's own hands, is treasured as long as there's a flight left in it. Fragile and scientific, it is an educational, psychological toy

TOYS FOR SALE

by E. F. LOUGEE

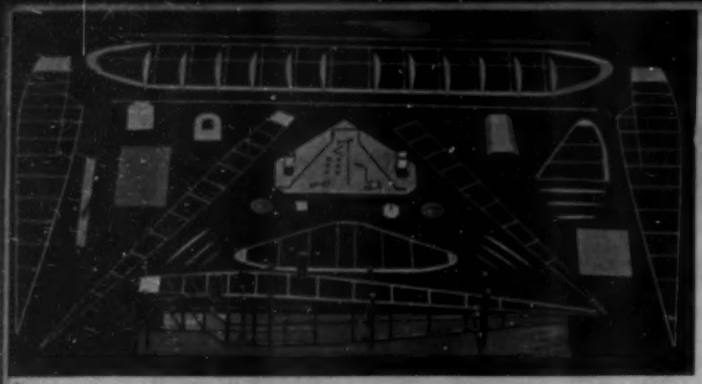
THE RAG DOLL AND IRON CART OF THE EARLY part of this century no longer satisfy modern youth at play. I use the word *modern* advisedly because children, if they are to be happy with their toys, must see in them some reflection of the things and situations they meet in everyday life. Nothing is more modern than a child between the ages of one and ten. He has little interest in history or antiques. History, to him, began but yesterday. He knows nothing about what came before and cares less.

If he is to be amused, or is to learn by voluntary experience in contact with physical objects, they must be of his world. They must be things he can quickly comprehend and enjoy.

It is all right for you and me to sit for hours over a game of chess—a game more than a thousand years old, but children won't do that. They want action and if they can't get action from the toy at hand, if they don't find it entertaining or amusing—then the toy is a flop.

The manufacture of toys is a business of ideas. Yet some of the cleverest ideas, when translated into toys, have failed to sell. This can usually be traced to the fact that they were adult ideas of little interest to the child.

On the other hand, one of the greatest successes ever realized in toy manufacture was when building blocks, which were popular at the turn of the century, were translated into modern steel construction forms which children of nearly all ages could understand and with which they could find ever-changing fun by building things along their own ideas. An even newer type of construction set is being produced by Southern California Trading Co. Put together, the pieces in the kit form an exact scale model of the Golden Gate Bridge. Originally, 29 pieces were used to put the model together, but since the adoption of molded plastics for the assembly, the number of pieces has been reduced to 9—two anchorage sections, two towers and five sections of roadway, all fitting according to accurate engineering.



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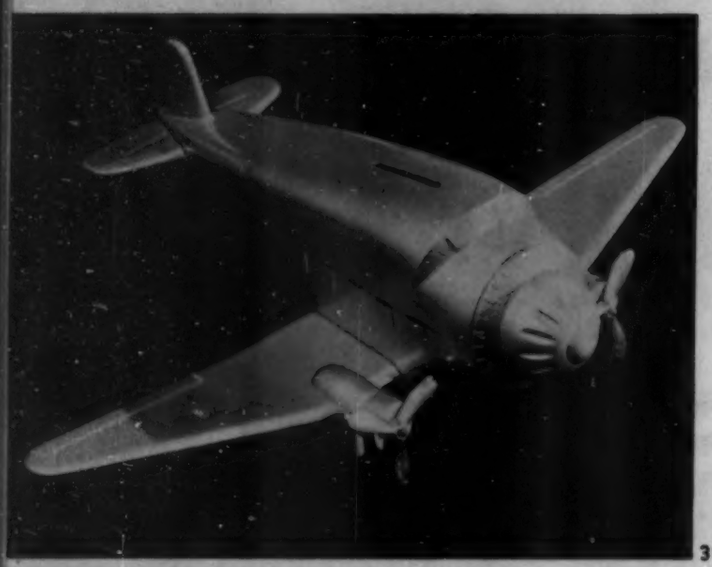

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Another example of psychology has been applied to the manufacture of model airplanes by the Washington Institute of Technology which recently announced its entry into this field. The Washington Institute of Technology is a research and development organization in the aeronautical and broadcast radio fields, and is the developer of Air-Track, the radio safe landing system.

Guided by the discoveries of child psychologists that over-complicated toys frequently contribute to inferiority complexes, the Washington scientists have pre-fabricated the major parts of each model, so that the model builder can produce a good plane even as his first attempt. The widespread popularity of the hobby of model airplane building and flying—last year many millions of dollars were spent for model airplanes and supplies—makes it inevitable that any builder will have to face comparison with planes built by others in his own neighborhood.

B. Russell ("Russ") Shaw, head of the airplane division of the Washington Institute, who was building models in 1908 and flying airplanes in 1910, points out that the pre-fabricated feature assures early success and shortens the building time to one-tenth that required with other kits.

"We believe that boys learn more in flying models than in spending their time at the work-bench building them," he said. "We feel that the tedious and tiresome job of cutting tiny parts out of balsa blocks and sheets with a razor blade is old fashioned and even though it may contribute a little to the manual education of a young model builder, it certainly adds nothing to his knowledge of the aerodynamics of design, structure or flight."

True, these are adult ideas but the building forms are so simplified and so quickly visualized by youngsters that the ideas clicked from the start. After all—an alarm clock is an adult idea but I never knew a youngster (including myself) who didn't delight in taking one apart if he could get his hands on it. Then he would spend hours trying to put it together again—without success. When failure became evident, he lost interest. But not so with the building sets because simple as well as complex plans were devised to entertain and educate children of varying ages and natural intelligence. The mere thought of being able to fly his own plane once it is built is incentive to persist until success is achieved.

That, perhaps, is where toy manufacture has made its greatest progress in the last twenty years. The useless toy has practically disappeared. In its place, educational toys have appeared which permit children to

4

5

1. Washington Institute of Technology, Airplane Division's Witkit parts for quick model building. Cellulose acetate dope is included in the kit to strengthen and prolong exterior tissue covering. 2. Built from a Witkit is the Triax, a 6-ft., tricycle landing geared, gasoline-powered model. 3. An incentive for saving pennies is the airplane bank molded of Durez for Dudley Crafts Co. by Waterbury Button Co. 4. Nine Bakelite parts, fastened together and presto! The builder has an exact scale model of the Golden Gate Bridge. Materials formerly used required 29 pieces to put the model together. Bakelite parts are molded for Southern California Trading Co. by Windman Bros. 5. Life-like toys and figures molded of Tenite in plain or variegated colors are virtually unbreakable and non-hazardous in the presence of fire. The airplanes, above, were molded by Modern Plastics Co.; autos, by Lapin Products, Inc.; figures, by Columbia Protektosite Co., Inc. 6-7. Believing that metal toy figures are dangerous when broken or put in a child's mouth, that they are heavy and not easily handled, Universal Plastics Corp. is experimenting with a line of molded plastic soldiers, Indians and such

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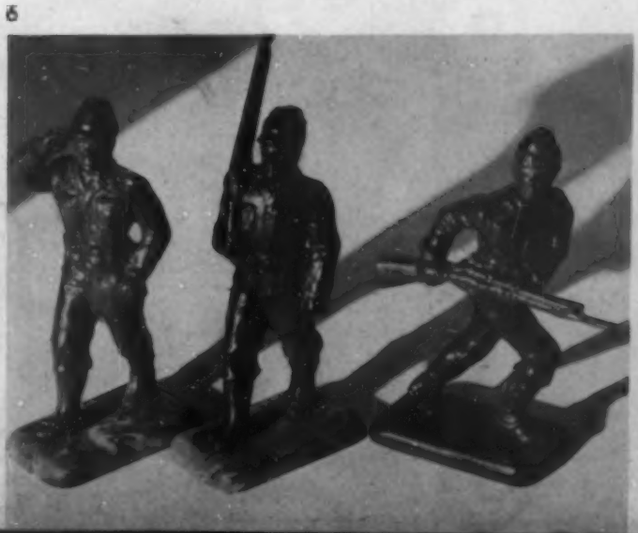

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8. Plastic playing pieces of Helios (the Game of the Gods) are true replicas of astronomical and astrological symbols, a feature that was found impossible to equal with wood. Their smooth, lustrous surface, that never dulls with any amount of play, is pleasant to handle and more acceptable, especially to women, than metal which was considered and rejected. These lightweight, long-lasting pieces were injection molded of Tenite for Universal Game Co. by Gits Molding Corp. 9. Endorsed by the American Chess Federation are chess men injection molded of ivory, black and red Tenite by Gits Molding Corp. 10. A new game, Hy-Lo, following the rules and play of auction or contract bridge, is carried on with playing-card tiles molded of Bakelite in either ivory urea or walnut phenolic. The tiles are molded for Bridge Headquarters, Inc., by Shaw Insulator Company

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exercise their natural talents and develop them—not in the conscious form of education, but in the spirit of fun.

If toys are to attract the attention of youth and create a desire to possess them, they should introduce some modern thought or modern theme of present day life. They should serve as an introduction to the child of the things in life in which he is beginning to show interest. The airplane, the automobile, trains, are examples.

I think, then, that it is generally conceded that toys—and games as well—which have educational possibilities incidental to genuine fun, are the ones most likely to sell. This is not my personal opinion, mind you, but is based upon recent conversations with many parents, observations and comments of youngsters themselves, and correspondence and conversations with many successful manufacturers of toys and games.

Materials from which toys are made are second only to ideas. They play an important part in merchandising, especially in repeated sales and sales through recommendation or word of mouth advertising.

A mother whose child was poisoned by playing with lead soldiers, is not likely to buy more soldiers for her other children as they come along nor to recommend them to other mothers nor give (*Please turn to page 64*)

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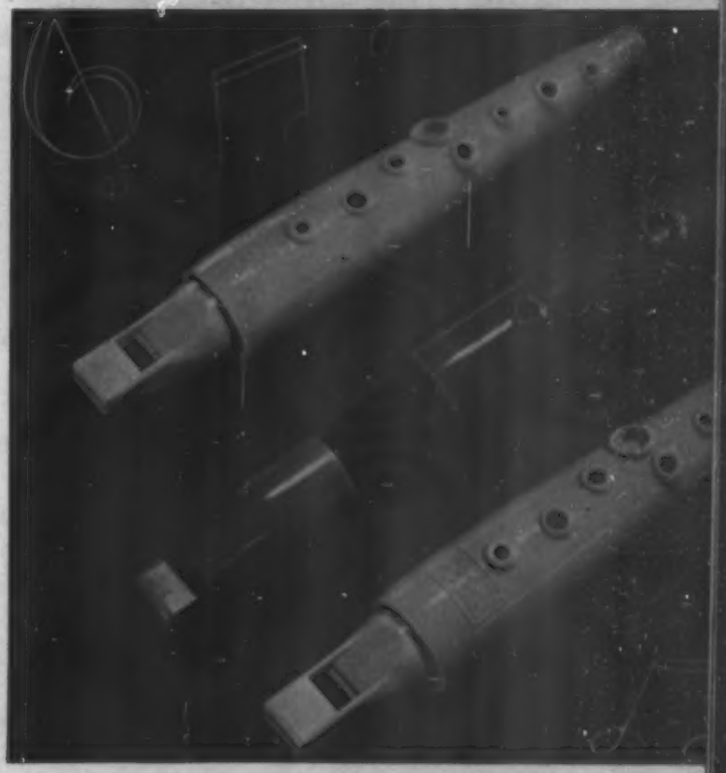

11. Metro Mfg. Co. has replaced wood with black Bakelite for its Everlasting Bingo Balls because: The old type wooden ball had a short life; it became soiled after being used a couple of nights and had to be replaced many times during the year. The plastic balls last indefinitely and are easily cleaned. They sell for less than twice the amount of the wooden ball but are actually less costly because of their long period of usefulness. This company plans to introduce plastic bingo balls before long in several different colors. Universal Plastics Corp. is doing the molding. 12. Each stop of the Tonette is automatically formed to produce a true-tone note of the scale. This musical instrument, made in two parts and assembled by inserting the adjustable mouth piece, is injection molded of Tenite for Chicago Musical Instrument Co. by Elmer E. Mills Corp. 13. Toy Ocarinas, are being molded of Masuron acetate for Fred Gretsch Mfg. Co. by Plastics, Inc. 14. Piccolets, manufactured by Carl W. Vandre, have a mouth piece and bell that are injection molded of Tenite by Elmer E. Mills Corporation

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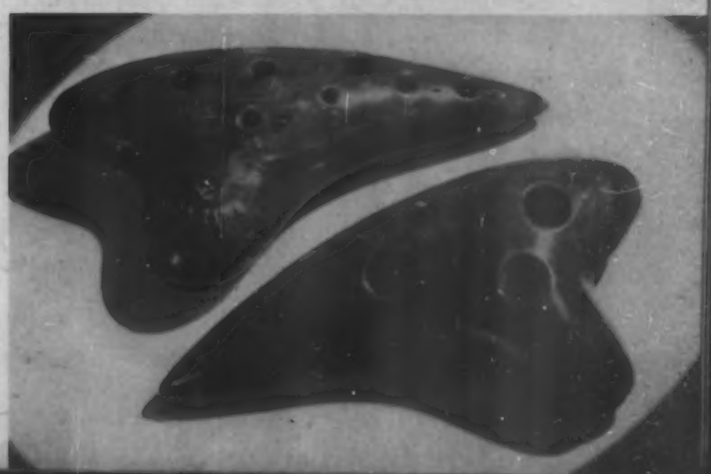


THE 1939 COMPETITION

Its purpose

Those in industry and design with interest in plastic materials—however slight their interest may be—have found in MODERN PLASTICS Competition a common ground where they can visit annually to watch the progress of this youthful industry.

Among the entries which will be exhibited at our editorial offices—122 East 42nd Street, New York—from October 1 to December 15, they can see the results of industrial and commercial imagination interpreted in the best examples of plastics production during the preceeding twelve months.

The Competition is designed to extend our editorial and educational efforts beyond the confines of our monthly publication and to provide our readers with plastic examples which they can examine at leisure without prejudice or persuasion. That, perhaps, is why the Competition attracts such an increasing number of visitors to the Exhibit each year.

Its scope

Designers and engineers who work with plastics, plastics materials manufacturers, molders, laminators and fabricators are welcome to exhibit as many entries as they please without cost or obligation. Entry forms will be sent to all who request them. There are sufficient classifications or groupings (12 this year) to assure proper recognition by the Judges to the 36 entries (3 in each group) which in their opinions represent the most practical applications of plastic materials in every field of industry and commerce.

These groupings, which have been extended this year to include separate classifications for laminated and cast materials—both industrial and decorative—have broadened the scope of the Competition to give greater opportunity to entries than ever before. They are completely outlined in the Entry Form.

Its rewards

No one can participate in the competition without some benefits because those visitors who are attracted to the Exhibit are industrial consumers in search of ideas. They come to learn just how plastics are being used in their own fields and frequently go away with brand new ideas discovered in some other field which they can apply to their own manufacturing plans.

They often learn about new materials and new applications from the Exhibit. They become acquainted with the work of independent designers who enter their designs. They learn about new processes, techniques, new ways of doing things with plastics which they never thought of before.

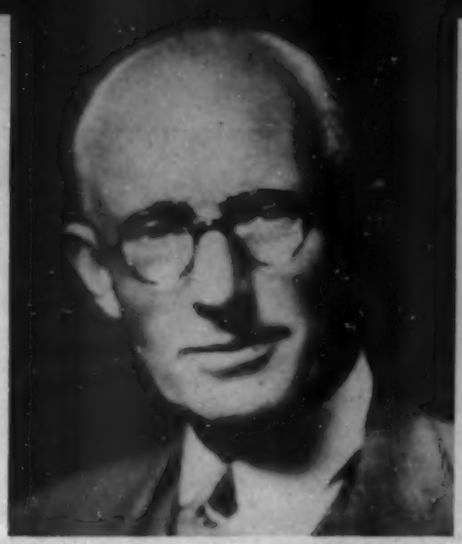
It would seem that these benefits were sufficient to encourage thousands of entries. But the resulting publicity in newspapers and magazines, which last year surpassed that of any previous Competition, is an added incentive.

This is especially true of the Winning Entries which will be photographed in color to become a part of MODERN PLASTICS' own sound film which was exhibited to more than 200,000 individuals in business groups throughout the country this year and is still being booked for months ahead at the present time. The film is a part of our own publicity program and is made available to any business or industrial gathering or college without cost.

Winners announced in November

The November issue of MODERN PLASTICS is devoted almost entirely to picturing and describing the Competition Winners. This means that your winning entry is carried into the executive offices of more than 9000 leading business concerns. November is always one of our most exciting issues and even our office copies are quickly exhausted a few days after the issue is off the press.

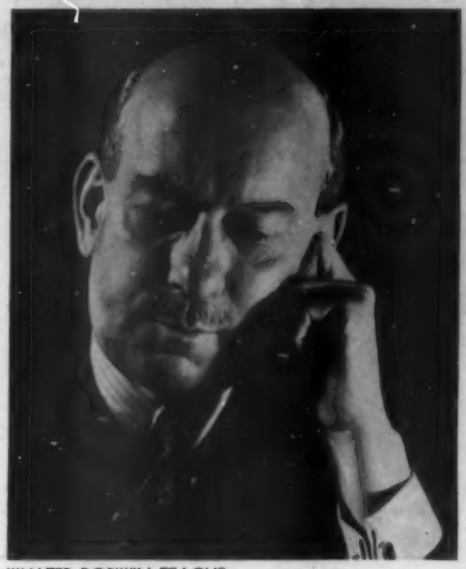
You may have gathered from these remarks that we are urging you to send your entries along before the closing date of the Competition which is September 23. We want to point out that there really is a grand opportunity offered by MODERN PLASTICS 1939 Competition to all those who take advantage of it.



HARVEY WILEY CORBETT

ALBERT E. MARSHALL

MORRIS B. SANDERS



WALTER DORWIN TEAGUE

GRACE ALEXANDRA YOUNG

THESE FIVE JUDGES WILL CHOOSE THE MOST DESERVING ENTRIES IN MODERN PLASTICS FOURTH ANNUAL COMPETITION

★ ★ ★

ALL ENTRIES MUST REACH OUR OFFICES ON OR BEFORE SEPTEMBER 23, WHICH IS THE CLOSING DATE. JUDGING WILL TAKE PLACE IMMEDIATELY AND WINNERS WILL BE ANNOUNCED IN OUR NOVEMBER ISSUE.

Harvey Wiley Corbett, architect, has served with each Board of Judges since the beginning of our Annual Competition in 1936. Mr. Corbett needs no further introduction.

Albert E. Marshall, who served for the first time last year, knows plastics intimately from origin to ultimate use since he is a chemical engineer. Mr. Marshall is President of the Rumford Chemical Works.

Morris B. Sanders, serving his third year as a member of our Jury, began designing in plastics materials many years ago. Mr. Sanders is an architect and design engineer.

Walter Dorwin Teague, consultant on the design of industrial products and one of the seven members of the Board of Design of the New York World's Fair, joins our Board of Judges this year for the first time.

Grace Alexandra Young, formerly Editor of Creative Design, has recently returned from European perambulations which included visits to England and France where she acted as our special observer at L'Age des Plastiques held recently in Paris. This is Miss Young's third year as a member of our Jury.

RIGHT TO A "T"

"MY SIZE IS SIX, BUT SEVEN FEELS SO COMfortable, I wear an eight!" Reminiscent, indeed, of Joe Miller's fabled collection but no joke to the many sufferers from ill-fitting shoes. Human comfort and health, it has been recognized, start from the ground up and the average consumer has learned to forget about his vanity and to demand accurate fitting of his footwear. Trial and error methods are out. The guess-work of so-called experience has been scrapped to provide for modern fitting in a way that instills confidence in the customer's mind and is practical and acceptable to shoefitters everywhere.

What characteristics should the ideal foot-measuring instrument possess? The device called for should be economical, light and easy to handle, decorative, scientific and explicit from the customer's viewpoint, yet simple enough for rapid calculation. Old-fashioned devices on which the foot rests were found to be unsatisfactory because it is difficult to keep the foot in the proper position. A far simpler and (*Please turn to page 80*)

Extreme accuracy and close tolerances are essential to the operation of this foot-measuring device. Boonton Molding Co. produces it of Bakelite for Charles Henry Brown & Son, Inc. Molds and models were made by John Kunst Co. Seven molded plastic parts and spring tape, shown above, are described on page 80. At the left is the unit completely assembled

REFLECTED LIGHT

by E. B. KIRK

AS A LIGHTING CONSULTANT, I NATURALLY have been interested in plastics as a medium for obtaining scientific lighting. I have watched the steady growth of this application for the urea type materials, and when requested by the Mitchell-Vance Co. to design a 300 watt semi-indirect luminaire, I decided to base my plans on the use of this material.

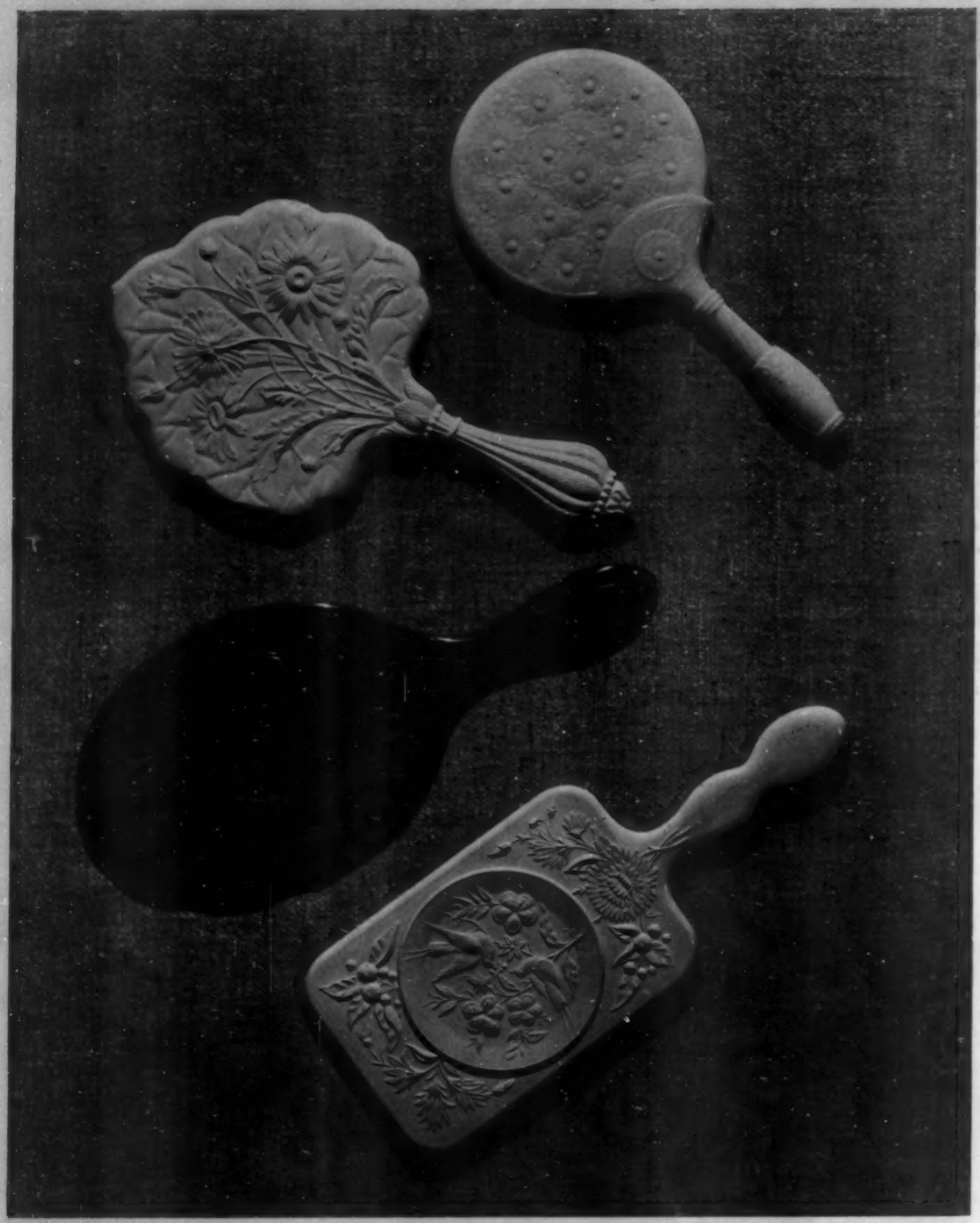
Plastics offered me several excellent tools with which to work; form could be accurately controlled and an exact reproduction of the original shape could be counted on once the die was constructed. Colors could be reproduced exactly, and because this type plastic is available in practically any color, it would be possible to obtain the tint most efficient and pleasant to the eye—and most important—be assured of getting it time after time. The flexibility of design was an appealing point; the intricacy of the design seemed to have little bearing on the cost of the finished part.

Naturally the first objective was to achieve the maximum light output without sacrificing eye comfort and appearance. The next objective was to obtain the most efficient use of the reflected and transmitted light. Lastly, the luminaire should be so designed as to present a soft comfortable glow to the eye.

It was possible, after a study of urea material, to gauge the lighting characteristics of each segment of the planned reflector before constructing the mold. By studying the various urea samples, it was possible to determine the amount of light which would be transmitted and reflected at various points on the bowl, depending upon the thickness of material cross section and incidence of the light. By accurate control of thickness, shape and color, an exact shading of light, pleasant to the eye, wide in spread, and efficiently used, resulted.

The "Plastolux," as this unit is called, has a central deep portion 9 in. in diameter, and 9 in. in depth. This bowl section is considerably thicker than the remainder of the luminaire, to reduce glare and to blend in a uniform manner with the complete reflector. Since the greatest amount of light will occur at this point, uniformity of light transmission and reflection was sought rather than uniform thickness. The reflector flares away from this bowl at an angle of 15 deg., with the horizontal thus presenting an advantageous angle of incidence to the important equatorial zone of radiation from the lamp. Through a series of concentric wavy rings, the thickness of the plastic gradually decreases so that the brightness of the most remote section is about the same as the central portion. By means of this gradual flare of the luminaire an excellent spreading of light results and although this reflector measures some 24 in. in diameter, it appears to be much smaller.

Plastolux reflectors, installed in the New York offices of the Santa Fe Railroad, were designed by E. B. Kirk for Mitchell Vance Co. and molded of Beetle by Mack Molding Co. One of the units is shown separately below



Fine examples of early plastic molding came to light in these Victorian designs recreated by Pho-phy-lac-tic Brush Co. from original molds made between 1860 and 1870. Modern cellulose acetate produced by Monsanto Chemical Corp. in delicate pastel shades, replaces the shellac molding compounds originally used

VICTORIAN AGAIN

by KARL J. EKLUND*

BACK IN THE 1870'S GRANDMOTHER GAZED proudly at her new dresser set. Mirror, brush, and comb rich in ornate design, they were the newest thing in boudoir appointment. Although grandmother didn't know it, they were also the pride and joy of a thriving young New England firm in Florence, Mass.

The firm is today the Pro-phy-lac-tic Brush Co., one of the largest manufacturers of toilet brushes of all types as well as the famous toothbrush by that name. The dresser set that grandmother had treasured back in the 1870's had been pressed from a shellac compound with steel dies. Today an overwhelming percentage of this company's brushes have handles of plastic materials, such as cellulose nitrate, cellulose acetate, or cast phenolic.

Some months ago, prowling in a store-room of the company, one of the supervisors came across a file of metal dies. Curious, he pulled one or two of them out to the light and removed their wrappings. They were the dies that had made the brushes, combs, and hand-mirrors of the 1870's . . . . filed away and forgotten for longer than an average life-time.

The dies were carefully examined and the thought occurred that perhaps they were still in usable condition. But would they work satisfactorily with the modern plastic materials of 1939?

Into the molding room went the dies, and while an interested group of technicians stood around, they were fitted into a press and a charge of cellulose acetate molding compound placed in the form. A few minutes later the assembled group were looking at a modern re-creation of an 1870 hand-mirror.

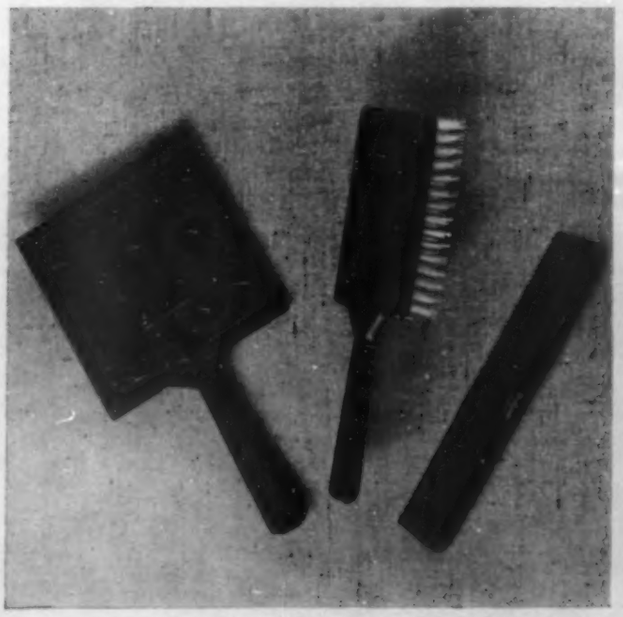
A sales executive watching the experiment immediately spoke up. "That's grand-looking Victorian . . . . and I bet it will sell." Further search disclosed an additional group of the dies, in fact a series of many distinct styles of dresser sets.

Today the Pro-phy-lac-tic Co. has added to its line a new group of sets, destined for the smartest homes in the country. Connoisseurs of Victorian and Mauve decade pieces will find them charming in their profuse decoration and quaint mottos such as "Give back smile for smile—frown for frown" which is found on the face of one mirror. Patent registrations still visible on the modern re-creation indicate that some of the designs were originated in 1860 and 1866.

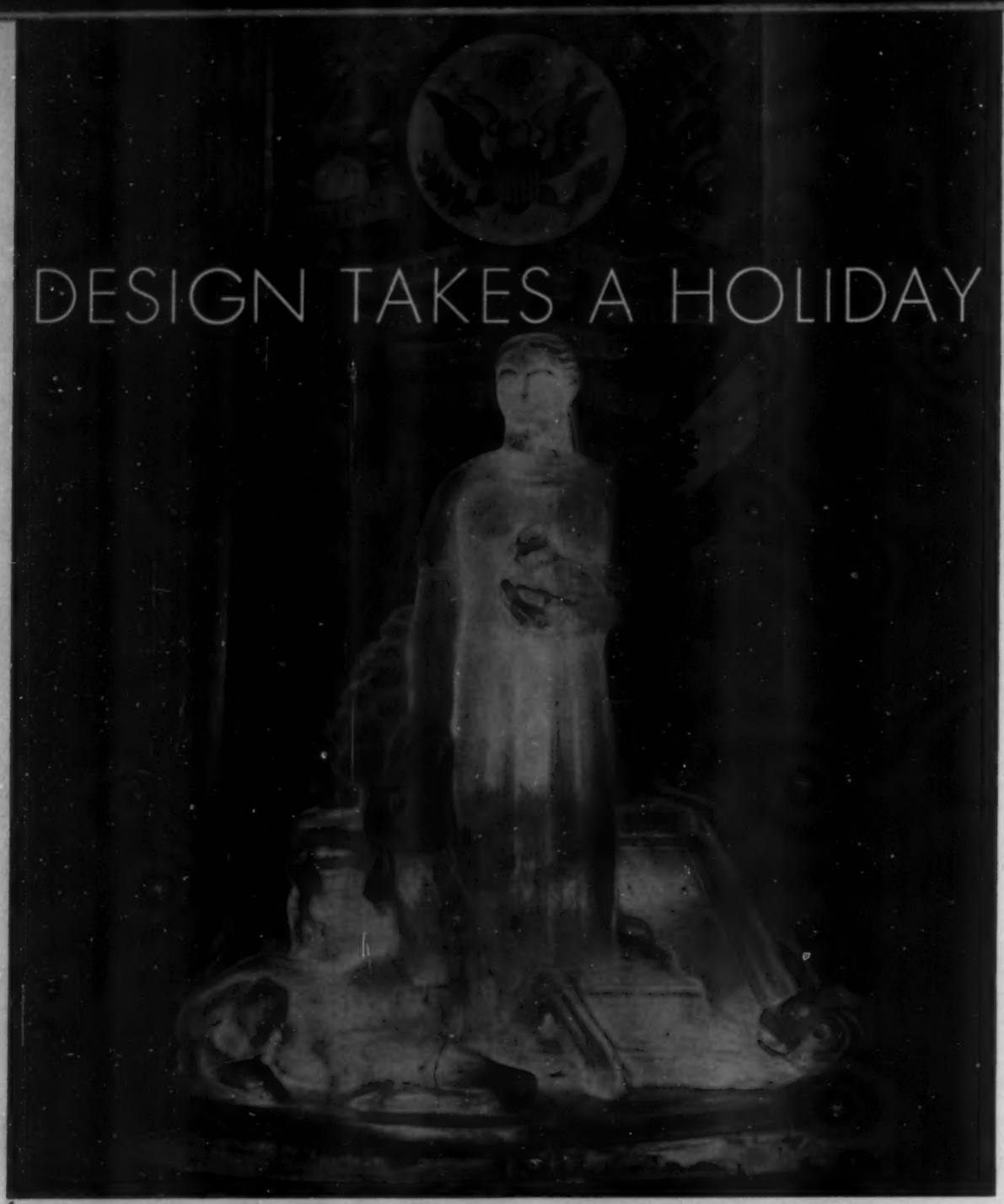
The sets are now being produced in modern, pastel plastic colors, but are made in dies that were hand-engraved by employees of the original Florence Manufacturing Co. The dies represent some of the finest examples of hand-engraving ever produced in this country. Several of them are museum pieces and have been sought by museums for their collections. No changes were needed in dies in order to produce satisfactory backs from acetate molding powder.

Perhaps the experience may prompt other long-established companies to see if they too do not have "buried treasure" on the premises. The craftsmanship and detail in many old dies and patterns represents a type of artistry which has largely disappeared from our modern industrial scene, even though our ability to appreciate its beauty is undiminshed.

* Plastics Dept., Monsanto Chemical Co.



DESIGN TAKES A HOLIDAY



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The statue (Fig. 1), one of twelve in the U. S. Federal Building, is cast from Marblette, a phenolic resin, by Art Plastics Co. Screen and figure, in a display of the French Perfume Industry at the French Pavilion (Fig. 2), are of Cristaplem, an acetate material. Both were cast in plaster of Paris molds and probably represent the largest castings of this sort ever undertaken

We, also, shall declare an editorial holiday and abandon our usual eliding of trade names in the text. Our reporter has spent much time tracing various materials to their source and wherever the name of the plastic used is known, it will be stated.
(Editor's note)

DESIGN IS THE MOST MOVING FACTOR AT THE New York World's Fair. Through the imaginative eyes of the artist, architect, designer and sculptor, visitors immediately are given a new mood. They unconsciously absorb a liberal education, are genuinely entertained and are practically overwhelmed by impressive design. Restrictions upon imaginative design have been withheld wisely by industry and commerce whose exhibits comprise the major attractions at the Fair.

The approach of these artists toward the problem of creating a setting of excitement and drama led them naturally to seek new materials and find new ways to use them. It gave them an opportunity to experiment and become acquainted with these materials and find out just what could be done with them. The interesting results emphasize the inherent opportunities laid open to many structural and decorative materials, some of which had never been thought of before.

The chemical resins called "plastics" have experienced their first major opportunity in the hands of these artists and the New York World's Fair offers America its first glimpse of plastics on a large scale—in art, in design and in industrial adaptations.

Plastics in Art

To the artist plastics represents one of the few interesting new materials which has come his way during the past thirty centuries. As a result, plastics are much in evidence in the art and design features of the Fair.

Henry Billings, commissioned by the World's Fair to do a mural decoration for the Chrysler Building, has made use of acetate and cellophane combined with Polaroid for a mural window. In his design a streamlined automobile, a diagrammatic drawing of an internal combustion engine and the symbols of a gear and a speedometer are integrated with planets, stars and com-

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The mural 62 ft. long, 20 ft. high (Fig. 3) executed by Domenico Mortellito for the Du Pont Building is made of Lucite and Plastacele sheeting. Pierre Bourdelle, in a series of mural panels (two are pictured in Figs. 4–5), in the same building, used Lucite, Velvetex, Plastacele, Fabrikoid, Cel-o-glas, Duco and rayon. Dean Cornwell used Micarta, a laminated material, for the background of his 56 ft. by 18 ft. mural (Fig. 6) in General Motors' Building, achieving his design in gold and silver leaf

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ets. A sheet of Polaroid, rotating behind the window, causes colors to change and gives an illustion of motion.

On the exterior of the Distilled Spirits Exhibit Building, Witold Gordon presents three murals, one of which is executed in plastics with metal and wood. Depicting the rye, corn and grapes from which liquor is made, the Gordon plastic mural is 450 sq. ft. in area.

In the Du Pont Exhibit, Domenico Mortellito has a mural decoration 20 ft. high and 62 ft. long, in Lucite and Plastacele. This crystal-like material is carved and sprayed with colored synthetic resins, wherever color is needed. Mortellito has used actual products where his design calls for them. Thus, where the subject of the design is nylon, the new Du Pont yarn for women's stockings, he uses actual nylon yarn.

In the same exhibit building Pierre Bourdelle presents a series of mural panels utilizing many products made by Du Pont—synthetic sponge, Lucite, Velvetex, Plastacele, Fabrikoid, Cel-o-glass, Duco, rayon, etc. Mr. Bourdelle is enthusiastic about the new materials.

"The excellence of plastics for artistic purposes need not be stressed," he says. "What the artist has always wanted is a material easy to transport, thoroughly malleable during the process of work, resilient and impervious to weather conditions afterward.

"Plastics have not as yet achieved the ideal state which will satisfy everyone. They are, however, easy to handle in transportation, soft to the tool, resistant to fire and the elements; they can be cast, molded, cut or built up; they can be opaque, translucent, transparent, light-conducting or fluorescent. The craftsman is enthusiastic about them. The artist dreams about Polaroid elements that will add another expression to his representation of life."

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Twin pylons, 165 ft. high, outside the Communications Building, are faced with translucent laminated Beetle, lighted from within (Fig. 7). Edge-lighted letters 40 ft. high (Fig. 8), and those below in Fig. 9, are cut from sheet Plexiglas, an acrylic resin which weighs about 45 percent as much as glass, is less fragile, but strong. Its peculiar edge lighting properties which permit light to be "piped" around corners recommend it strongly for display design

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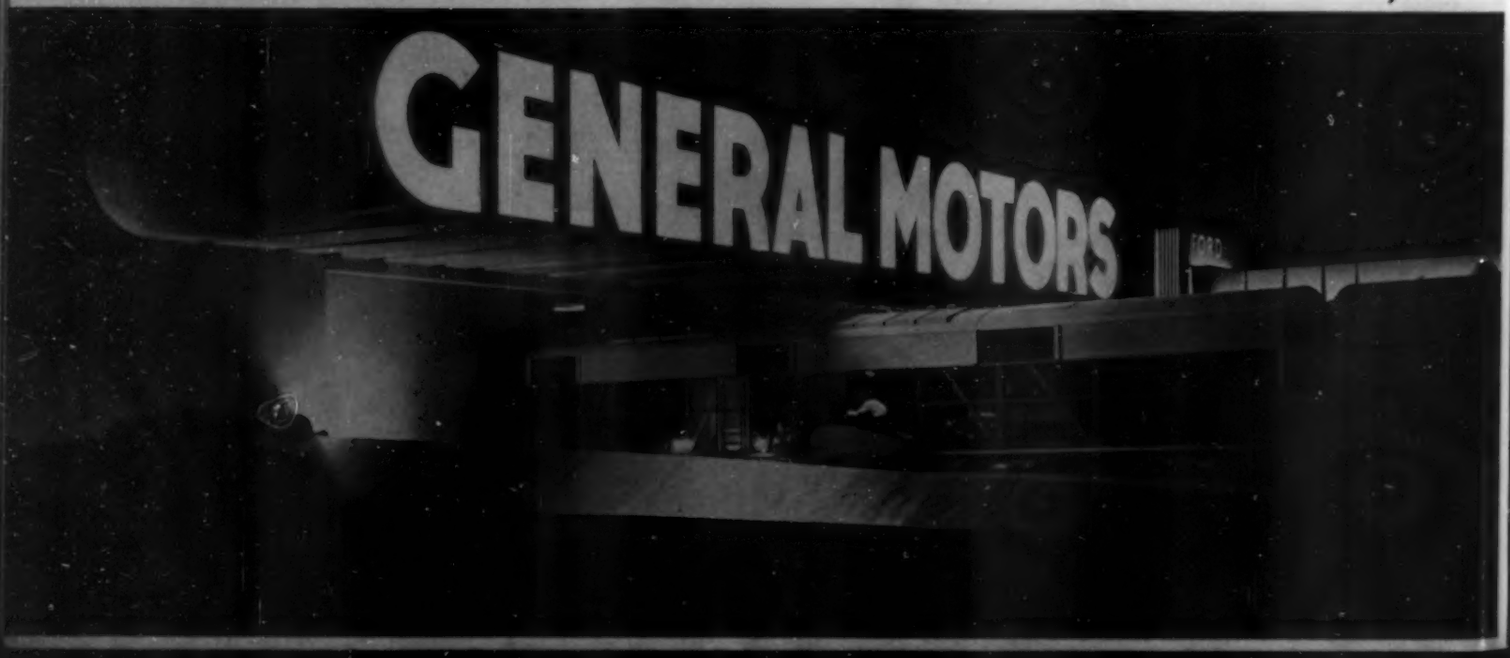

A whole section of the enormous "Bill Jones" mural in the Consolidated Edison Co. Building at the Fair has made use of plastics. This presentation, a new idea, and an idea typical of the changes brought about in business life by corporations with social consciousness, is dedicated to the employee. It depicts the life and times of Bill Jones, an average Consolidated Edison worker—his job, his insurance, his safety precautions, and so on.

The Federal Building at the Fair exhibits, along with an exceptional collection of sculpture in plaster, twelve large, translucent cast Marblette statues depicting the various functions of Government.

These one-piece hollow castings, executed in sets of four by three contractors, are 9 ft. tall, 8 ft. across at the base, and weigh from 1500 to 2000 lbs. apiece. Believed to be the largest phenolic castings of their type ever executed, they are worthy of especial attention, since nobody has ever seen anything like them.

The object was to present, in simple and striking sculptural form, portrayals of the specific functions of Government. Heavy female molds in plaster were made from the artists' originals. These were reinforced with structural steel. Male molds were then prepared. The faces of the molds were lined with a thin, tough foil to render them water-tight, after which they were sprayed with rubber to allow for expansion and contraction and to insure a clean impression in the pouring. The plastic material was poured in a molten state, after which the statues were cured for three weeks at 180 deg. F. The interiors of the pieces were sand-blasted to permit even light-diffusion.

All twelve of these sculptures are lighted from within. More interesting still, they provide the only source of illumination in the giant hall in which they are placed.

Textolite-Parkwood, a woven wood laminated with phenolic resin, is used to surface the kiosk (Fig. 10) in the General Electric Building. Laminated Insurok is used as a lettering band on this Information Booth (Fig. 11). Formica, a laminated material, is used for interiors and counter tops in all 80 of Child's "Quickies" (Fig. 12) as well as for the doors and wainscot of the National Biscuit Co.'s theater (Fig. 13). General Electric's theme symbol—125 ft. stainless steel lightning bolt (Fig. 14) is lighted through oval strips of translucent laminated Textolite

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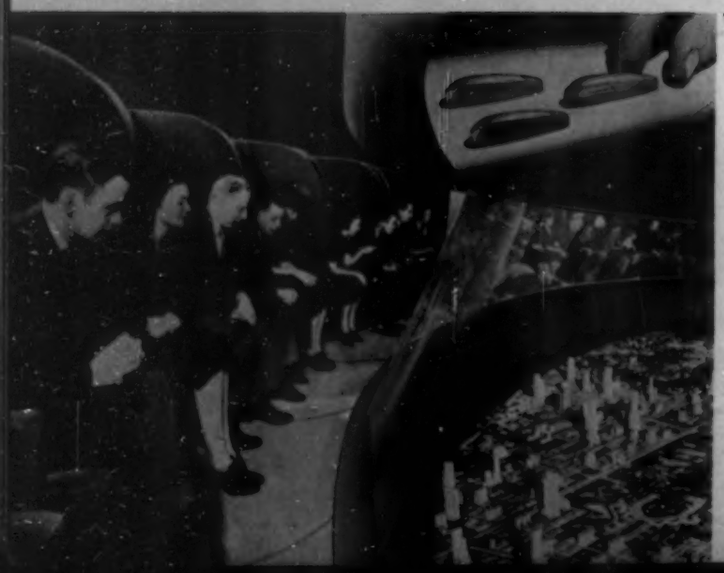

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There are two murals by Dean Cornwell in the Fisher Body Exhibit in General Motors' Building, each 18 ft. high by 56 ft. long. Together they portray the various steps that enter into the design, molding, bracing, assembling and finishing of an automobile body. To achieve a remarkable effect, Mr. Cornwell tells the story through the use of gold and silver leaf applied by hand on the Micarta wall.

This plastic was considered desirable for the purpose because it conceals the grain of the wood to which it was veneered, does not absorb moisture, is highly durable, and affords an even surface.

In the Heinz Building, under the direction of Willi Noell, Juan Oliver and Viktor Harasty present kitchen scenes reminiscent of yesteryear and scenes of today. Four plaques, projecting from a Micarta background, tell the story. The aim of this display is to capture the flavor of periods in American life within the memory of the average Fair visitor.

Plastics in Architecture

Geographical peculiarities of the World's Fair site are responsible for one brand-new use of plastics that could not have been predicted by the experts.

Long Island is flat. To relieve the monotony of the terrain, Fair architects decided to send towers soaring into the air at strategic points about the grounds. The problem which arose was that of dramatizing these pylons. It could be done by illuminating them from within, it was seen, but that called for a translucent material which would at the same time be capable of enduring the structural strains involved.

Before the Communications Building stand two tall red and blue pylons, 165 ft. high, faced with translucent laminated Beetle. The same material, which has shown considerable adaptability, is used on the pylons of subway entrances to the Fair Grounds, on the lettered band of one or more Information Booths, in the lighting equipment of the Hall of Industrial Science and in the foyer of the Perisphere.

For minor uses, a considerable amount of plastics are used in various restaurant buildings on the Fair Ground. Louis Allen Abramson, architect of the Brass Rail Restaurant, remarks: "We are still unaware of the extent to which plastics will eventually be used, in my

Figs. 15–16 illustrate the Coronation Scot, a British train using Bakelite laminated for many interior decorative parts. General Motors chose Pontiac for this visual exhibit (Fig. 17) made entirely of clear transparent Plexiglas. Even the tiny cars in G-M's Futurama (Fig. 18) are molded Lumarith. In the Ford Motor Co. Building plastics have been used prodigiously by Walter Dorwin Teague who designed the exhibits. Fig. 19 shows the huge revolving display on which manufacturing processes are humorously portrayed by miniature models (Fig. 21) many of which are made of plastic materials. A Lester injection molding press (Fig. 20) is in continuous operation. The huge flame in the Gas Products Building (Fig. 22) is Plexiglas while the Lederle Laboratory Exhibit (Fig. 23) in the Medical Building is faced with laminated Beetle

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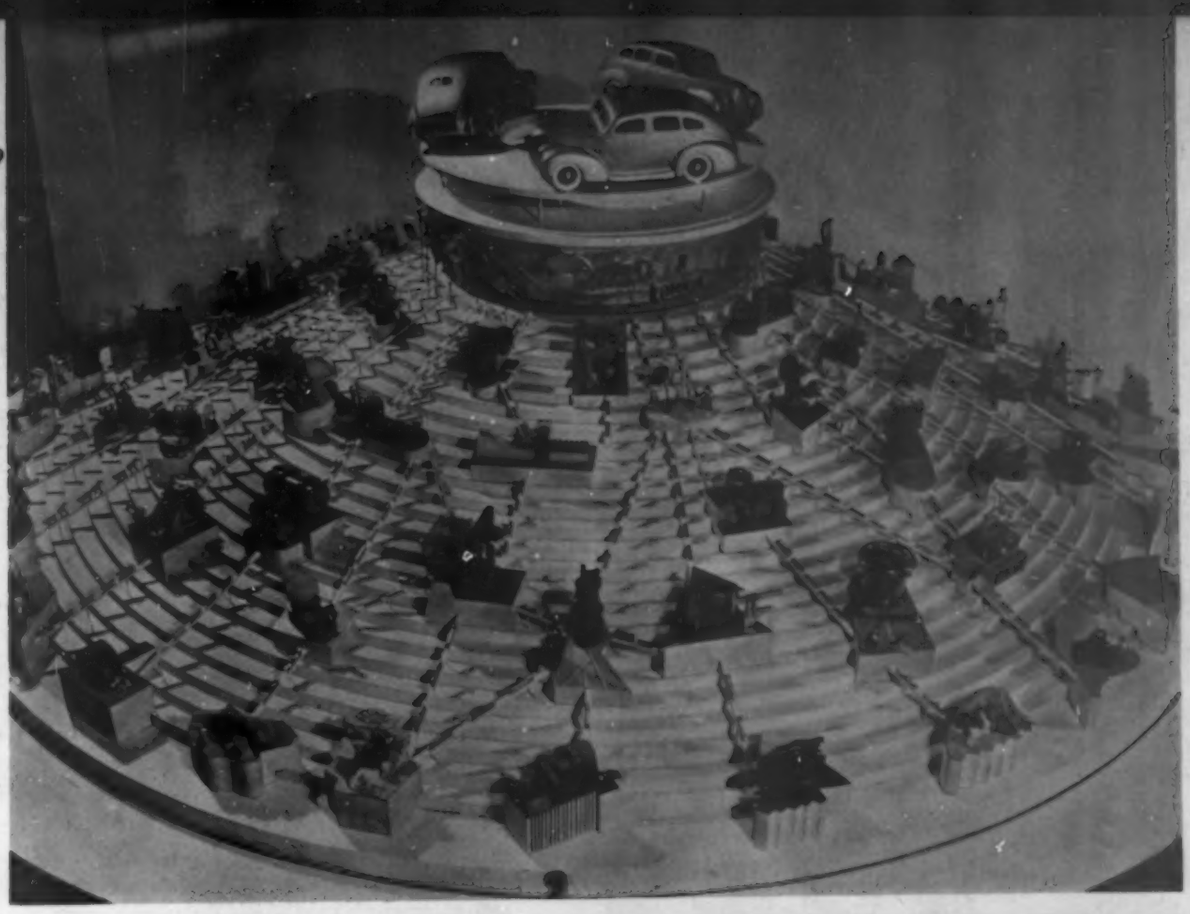

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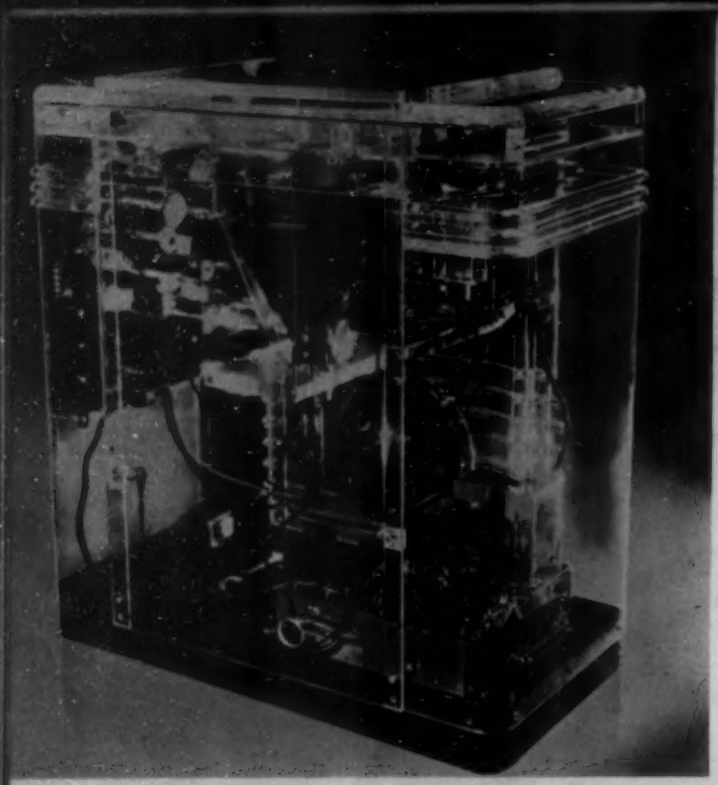

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opinion. The field is untouched." Table tops in the Brass Rail are of yellow and red Formica.

This same laminated plastic forms the doors and wainscot of the National Biscuit Co. theater; counter top and front in the American Tobacco Co. exhibit; and counter tops in the eighty Child's hot-dog emporiums.

Micarta, also a laminated plastic, is used in the General Motors Building in its circular unloading platform, on which the public alights from the conveyor which carries it through the popular Futurama spectacle. Even the comb plate of the platform is of this material rather than the usual steel construction.

Panels of four electric stairways and two triangular pillars in the Fisher Body Building are also Micarta, as are counter tops and display table tops in the Heinz and Westinghouse Buildings.

Plastics in Design

The designer, perhaps even more than the artist, is always interested in new materials. In a changing world a new medium is an important item of his stock in trade.

Hence, designers have drawn extensively upon plastics in their work at the World's Fair. Walter Dorwin Teague, who represents his profession of Industrial Design on the World's Fair Board of Design (which commissioned Mr. Bourdelle and Mr. Mortellito) and who designed a number of the Fair's leading industrial exhibits, believes the most interesting new development in the field of plastics—as shown at the Fair—is their widespread use in the Exposition's murals and sculptures.

The complexities of television are easily seen (if not comprehended) in this RCA set with Plexiglas cabinet (Fig. 24). The Diorama Corp. designed the visual map (Fig. 25) for the Pan American Union Building. It is 27 ft. by 20 ft. and cast from Marblette in plaster molds by Art Plastics Co. The Hoover Co. uses a transparent Monsanto acetate tube to demonstrate the suction power of its sweeper (Fig. 26) while the Rhomboid crystal (Fig. 27) in the Pennsylvania State Exhibit is made of a similar material called Lumarith

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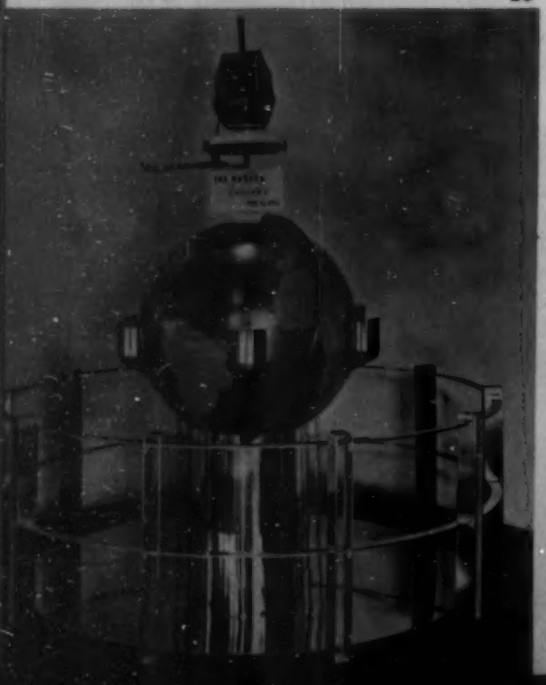
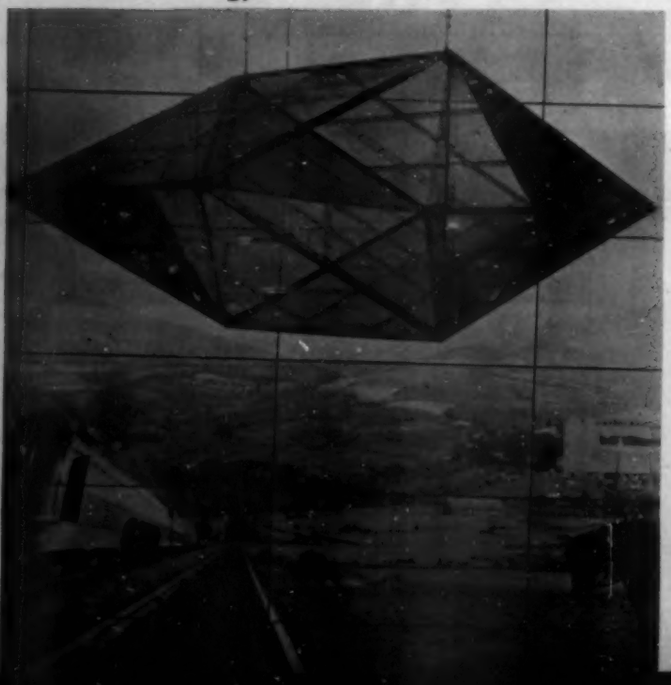


27



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The most comprehensive display of plastic products at the Fair may be seen in the Hall of Industrial Science where the Bakelite Corp. shows hundreds of applications (Fig. 28) as well as injection (Fig. 33) and automatic compression (Fig. 34) molding presses in operation. Röhm & Haas exhibits (Fig. 29) many applications of Plexiglas in this building together with visual presentations of fabricating methods. Three molding presses (Fig. 30) are operating in the General Electric Building

"The artists, in seeking to interpret the message of the Fair," says Mr. Teague, "have chosen the materials of our own day, and they are discovering aesthetic possibilities in media they never used before. Not for centuries have experiments been made in new materials for the arts of expression on a comparable scale, and it is clear that among the most stimulating of these experiments are those employing plastics.

"In the hands of capable and imaginative artists, the aesthetic possibilities of industrial materials, particularly plastics, seem to be unlimited. This is the age of chemistry and the machine. Art and industry at the Fair are helping to broaden the base on which the artists can interpret that age in its own characteristic materials."

The Ford Motor Co., which pioneered in the large-scale utilization of soybean plastics, offers at the New York World's Fair one of the most comprehensive exhibits of its kind ever constructed. This exhibit, known as "The Ford Cycle of Production," includes eighty-seven models, many of them animated, depicting raw material production, processing and other operations involved in the manufacture of a Ford motor car.

Throughout this display, and in other portions of their exhibit, the Ford designers and model-makers have used plastics extensively. Plexiglas, with its high light transmission, affords spectators a clear view of various operations. For example, it simulates molten metal and the "coking" of coal through unique edge-lighting.

Lucite aids in depicting various other processes, and Catalin has been freely used in the horns, noses and eyes of the various figures in the exhibit. A Lester automatic injection molding press is in operation.

Such extensive use of the new materials constitutes a striking demonstration of the knowledge acquired in the plastics field during the past few years by the automotive industry. It goes without saying that the automobile today is a rolling showcase for plastics. Horn-buttons, steering wheels, instrument panels, fixtures—more and more, plastics are coming into extensive popularity with the automotive designers.

An outstanding use of plastics in the construction of the General Motors Building at the Fair, according to Norman Bel Geddes, the designer, was his use of Plexiglas, for the exterior facings of the big General Motors 24 ft. by 10 ft. sign with cantilevered letters, over the Diesel train (Fig. 9). The entire surface of the transparent material is illuminated from behind by fluorescent lamps manufactured by the General Electric Co. The resultant cold light is perhaps the most extensive ever effected in any one sign.

Another use of the material is made in the lettering of the automobile signs at the street intersection adjacent to the focal exhibit in the (*Please turn to page 72*)

GONE

Illustrated on the opposite page is the new Catalina model, Silex Glass Coffee Maker. Beauty, convenience, and delicious coffee are the advantages of this new Kitchen Range Model which make it a favorite among housewives everywhere. Metal parts are handsomely finished in soft satin chrome. The artistically designed bowl handles are molded of Ivory Plaskon. The combination of gleaming metal, sparkling glass and rich Plaskon fittings produces an effect worthy of the hospitality of the most gracious hostess.

Manufactured by THE SILEX COMPANY
Creators of the Glass Coffee Maker Industry
Hartford, Connecticut
PLASKON Fittings Molded by THE SILEX CO.

GONE ARE THE DAYS of gallon size coffee pots that simmered on the stove from sun to sun. Gone, too, is father's pint size cup with its never-to-be-forgotten mustache bumper.

Today we make our coffee quicker, easier, more wholesome, more delicious—serve it in a daintier, more tempting fashion.

Increasing sales of labor-saving equipment for the home are due as much to attractive styling as they are to efficient performance.

Of all the newer materials that have been adopted for the restyling of products, plastics easily take the lead. And of the various types of plastics, Plaskon is a strong favorite among outstanding manufacturers of products ranging all the way from buttons and bottle caps to radios and light reflectors. In fact, Plaskon is the world's largest selling urea-formaldehyde plastic.

Molded Plaskon has characteristics that are unusual. It is made in a range of colors that only nature can rival—colors that never fade. Plaskon is solid molded color. It will not chip, rust, corrode or tarnish. It is odorless, tasteless, inert—resists the effects of water, oils and organic solvents. Plaskon transmits and reflects light to an amazing degree. It has great dielectric strength—low degree of heat transference. Plaskon is light in weight. Its surface is hard, smooth and easy to keep clean.

To men responsible for product improvement, Plaskon offers an advisory service based upon long experience in the field of plastics plus unrivalled facilities for scientific research, creative design and expert engineering. Consultation entails no obligation. For further information and technical data, write or wire

PLASKON COMPANY
Incorporated
2121 SYLVAN AVE. TOLEDO, OHIO
Canadian Agent: Canadian Industries, Limited, Montreal, P. Q.

ARE THE DAYS

Trade Mark Registered

PLASKON

★ MOLDED COLOR ★

B46-178
MINN·1939

1

Plastics In Review

2

1. Designed to discourage automobile thefts and "hit and run" drivers, the illuminated V. & H. automobile rear license plate, made of colored translucent laminated plastic material, cannot be defaced, tampered with or removed from its special steel mounting without completely destroying it. Not yet in commercial production

2. Strikingly different, decorative stairway in W. & J. Sloane's House of Years is made of clear Plexiglas panels set into an iron frame, with a molded iron hand rail. Vertical rods of the same material separate the panels. Etched design lines are sand-blasted in. A single acrylic sheet, bent around a 2-in. solid plastic rod, forms the newel post. Lightweight, the material is easily cleaned and practically unbreakable

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3. Proctor model electric clock has a one-piece plastic housing with sweeping molded-in design at the corners. Auburn Button Works, Inc., mold the case of light ivory, pastel green and light red Plaskon for the Seth Thomas Company

4. Black insulated handle and heat adjustment lever of the Proctor & Schwartz "Never-Lift" electric iron are molded of Durez by General Industries Co. Baked Dulux enamel, black and red chromium-plated cover plate is a product of L. F. Grammes & Sons, Inc. Release button raises ironing surface for use

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6

5. Pick your own—Miniature "Wonder Bar," 4 in. by 5 in., and minute replicas of bonded liquors topping cocktail spears, are made of Marblette by Ace Plastic Novelty Corp. Tiny recipe book is hooked on beneath the metal rail

6. Dual Range voltmeter, part of the automotive accessory equipment manufactured by Bendix Radio Corp., has a

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yellow housing, red terminal screw and purple push-button molded of Textolite by General Electric Company

7. Athletic glamour girls find sun protection behind "Beverly" goggles, set in broad frames of Monsanto cellulose acetate, made by Columbia Protektosite Co. Ample defense against wind resistance, dust and rain is provided by the "Bronco" Bike Shield made from Monsanto cellulose nitrate by International Manufacturing Company

8. Pistol-grip balanced handles and cover knobs, welded to the utensil, are molded of heat-resistant Bakelite by Auburn Button Works, Inc., for Revere Copper and Brass, Incorporated

9. "Wiz" sales recorder, developed by Knauth & Benninghofen for American Sales Book Co., is lightweight and convenient to handle. Two-piece housing in bright shades of Beetle is molded by Reynolds Spring Company

10. Attractive modern building and furniture hardware, drawer pulls, handles, knobs, in various colors are injection molded of Tenite by Bridgeport Moulded Products, Inc., for Ever-Ready Hardware

11. To prevent clogging of type, swelling of typewriter feed rolls and platens, tearing of stencils by stylus pens, a sheet of Lumarith Protectoid foil is used by Henko Supply Co. as an oversheet for its duplicating stencil

12. Look and listen! Transparent Lucite clarinet made by the Pedler Co. and introduced by Paul Whiteman and Al Gallodoro at the George Gershwin Memorial Concert, is said to have a special reedy tone quality particularly adaptable for the famous "Rhapsody in Blue"

MODERN INDUSTRIAL TERMINOLOGY

by D. A. DEARLE

Whether you sign your mail as designer, engineer, purchasing agent or president, these new industrial terms should be familiar to you

DURING THE PAST FEW YEARS NEW APPLICATIONS for plastic molded parts have continued to appear on the market at an ever-accelerating pace and present indications point to even a greater expansion in this industry throughout the next decade. Each year seems to have brought forth either new materials or different methods of manufacture and now that automatic presses are being installed in many molding plants, the enterprising industrialist is faced with the necessity of keeping in closer touch with the numerous factors which contribute so much to the improvement of his product.

Of great significance is the fact that product design in practically every industry has been undergoing a slow, yet decided change. On account of the rapid strides made by both the plastics manufacturers and fabricators of molded materials, the designing engineer has been forced to watch closely the many different phases of this industry. One day he hears of phenolic materials being molded in vertical ram presses and next he learns of self-contained units, or perhaps a new type of injection machine. Terms such as extrusion dies, acetate materials, transparents, thermoplastics, nitrates, acrylates, etc., etc., ad infinitum, are presented in such rapid succession that the whole industry seems to assume kaleidoscopic motion in his mind. As a matter of fact it is difficult for even those engaged in the industry to keep abreast of everything that is going on in the way of improvement, and therefore, it is no wonder that the alert industrialist encounters trouble in doing likewise.

In order to gain at least a fair knowledge of some of the latest developments it might be helpful to briefly discuss some of the most recent phases of the molding process as they apply to product design. In addition, a cursory glance at the prevalent terminology may prove to be of assistance to those who come in contact with the engineers engaged in the molding business. With this thought in mind the following brief dissertation is presented. Before discussing these points, however, it should be kept in mind that, regardless of the improvements in either materials or molding methods, simplicity in design is still of greatest importance. No extent of molding advancement has, as yet, changed this principle, nor has the introduction of new molding materials affected it greatly

Perhaps the most widely discussed subject at the present time is the injection process of molding. This term is applied to the method of producing molded parts whereby a preheated plastic material is literally squirted into the dies under direct pressure, and instantly cooled before ejection. All operations are accomplished automatically, including the final ejection of the finished parts. The designing engineer should have at least a scant knowledge of just what to expect in a piece made by the injection process and he should also know whether or not a part is applicable to this method of manufacture when giving it consideration.

The one great merit of injection molding is that of economy in both the time and expense required for producing the goods. Lower cost of manufacture is accomplished, first, by the much higher rate of production found in the pressroom and, secondly, by the reduction in finishing costs. Instead of cure times ranging from one to four minutes, cycles of three or more heats a minute may be maintained in the injection machines. In the finishing department extended flash lines on the product are not found to be in evidence for in their place are found single spot cut-offs and hence the amount of finishing required is reduced proportionately. To partially offset these various savings in labor is the fact that the initial investment involved in the purchase of an injection machine is usually much greater than that required for the conventional press. Furthermore, maintenance costs sometimes have been found to exceed those necessary on standard equipment, but regardless of these points an ultimate saving is regularly realized as a result of the increased production efficiency.

So far as the terminology associated with this type of molding is concerned it should be noted that with present equipment only the thermoplastics can be molded by the injection process, and these include chiefly the acetate, acrylates, vinyls and styrenes. Thermoplastics are known under numerous trade names and are generally used when it is desired to produce finished parts in either the clear pastel shades or the transparents. There are many instances where black also appears as a thermoplastic but only is such selection made when greater resilience in the finished part is desired.

New equipment is being developed in which thermosetting materials can be injected with the same speed and efficiency now associated with the thermoplastics.[1] No cooling of the molds is required because thermosetting plastics may be ejected hot.

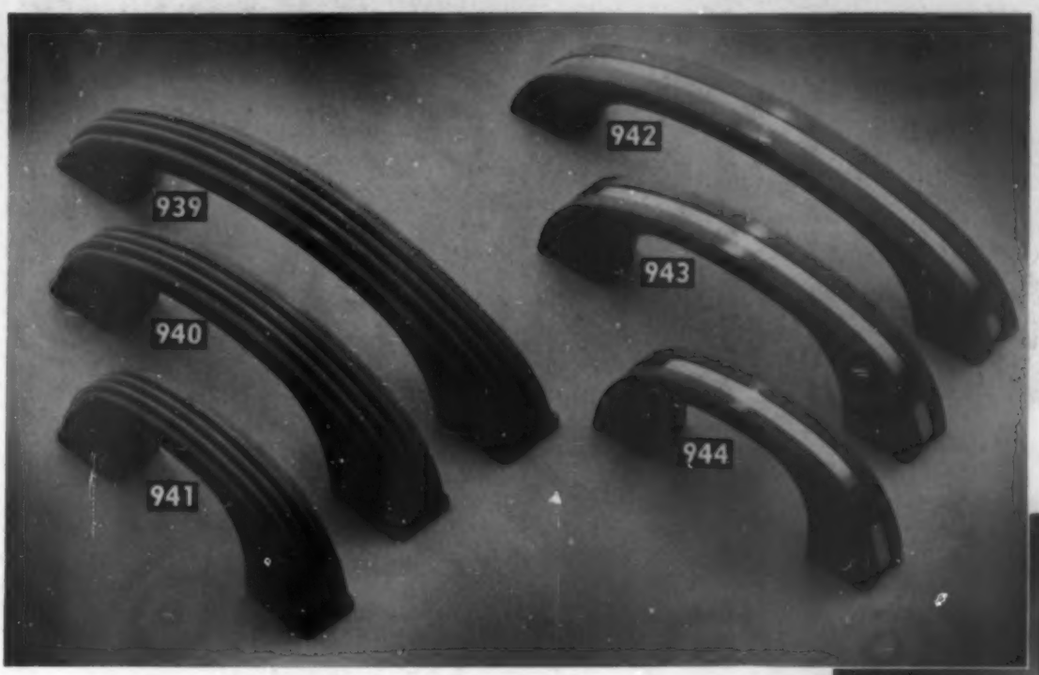
Whatever changes have been made in the size of molding presses is of no concern to the product designer and, therefore, it is unnecessary to dwell further on this phase of the business. Suffice to mention that presses are constantly being made larger and, as a result, molded pieces of prodigious proportions are gradually making their appearance on the market. New materials, however, present a different story, for with their introduction comes the need of investigating their respective application to utilities of every description. (*Please turn to page 78*)

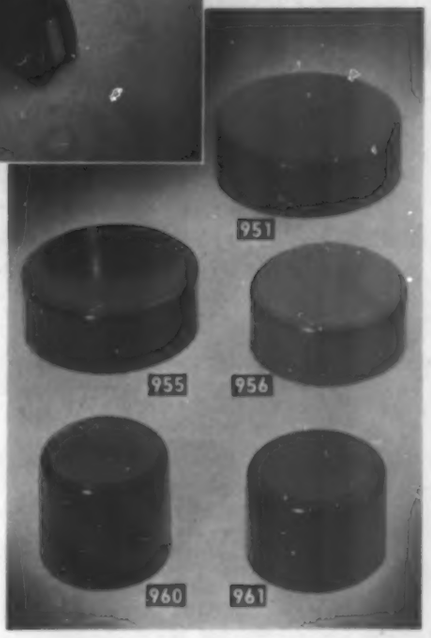
[1] The Changing Pace, Modern Plastics, page 29, July 1939.

Stock Molds

SHEET EIGHTY-THREE

Decorative handles, suitable for many different purposes, and bottle caps in several sizes may be obtained without mold cost from stock molds. Give item and sheet numbers when requesting molders' names and addresses





939. Curved handle, ridged on top and smooth underneath, 9/16 in. long and 9/16 in. wide. Assembly includes threaded metal openings 1/8 in. in diameter for attachment

940. Curved handle, same as above but 3 9/16 in. long and 1/2 in. wide

941. Curved handle, same as above but 2 1/2 in. long and 7/16 in. wide

942. Curved handle with 1/8 in. wide metal strip inserted in the top. Handle measures 4 5/16 in. in length and is 9/16 in. wide. Fitted with threaded metal openings for attachment, 1/8 in. in diameter

943. Curved handle, same as above but 3 5/16 in. long and 1/2 in. wide

944. Curved handle, same as above but 2 5/16 in. long and 7/16 in. wide

951. Decorative shallow finish, 38 mm. threaded cap, 1 7/8 in. overall diameter, 1/2 in. high

955. Decorative shallow finish 33 mm. threaded cap, 1 5/16 in. overall diameter, 1/2 in. high

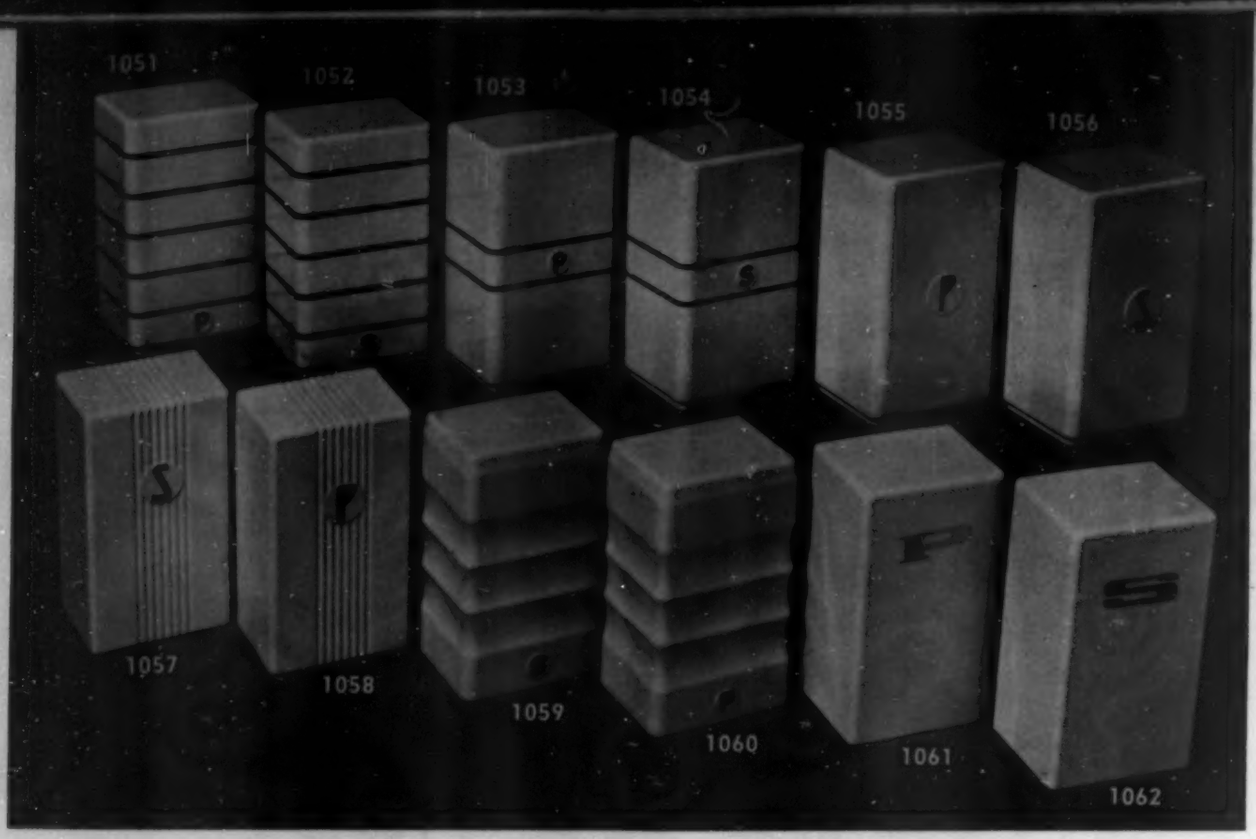
956. Decorative shallow finish 30 mm. threaded cap in red. 1 3/16 in. overall diameter, 1/2 in. high

960. Decorative tall finish 24 mm. threaded cap, 7/8 in. overall diameter, 3/4 in. in height

961. Decorative medium finish 28 mm. threaded cap, 1 in. overall diameter, 11/16 in. high

Address all inquiries to Stock Mold Department, Modern Plastics, Chanin Building, New York, N. Y., giving item and sheet numbers. All molders are invited to send samples from stock molds to appear on this page as space permits

Sheets One to Fifty-Two reprinted in book form, twenty-five cents in coin or stamps



Stock Molds

SHEET EIGHTY-FOUR

Salt and pepper shakers have large perforations for dispensing and rubber stopper for refilling, at the back. Each is 2 3/16 in. wide, 3 3/4 in. high and 1 5/8 in. deep. Sets, available without mold cost, can be matched with range timers or minute minders in standard color combinations. Cigaret cases are obtainable from stock molds with or without symbols

---

1051–2. Condiment set features five horizontal grooved lines in contrasting color. Initials on circular backgrounds are located at bottom, depressed in housing

1053–4. Condiment set with two depressed contrasting lines running horizontally around the casing. Depressed initials on circular backgrounds are centered between these grooves

1055–6. Condiment set in smooth finish, solid color casing with depressed "S" and "P" initials on circular backgrounds in contrasting shades

1057–8. Condiment set in modern design with vertical ribs and depressed letters in contrasting colors on circular backgrounds

1059–60. Condiment set with smartly fluted sides for both appearance and ease of handling. Initials in contrasting color are set on circular backgrounds

1061–2. Condiment set in solid colors with high finish chrome letters cemented to the cases

1049. Hinged cigaret case with metal World's Fair symbol insert and spring clips to hold cigarets in place. Inside dimensions, 3 1/4 in. long by 2 in. wide. 5/8 in. deep at center

1050. Hinged cigaret case, same as above, but inside dimensions are 3 3/4 in. long and 3 1/4 in. wide. 5/8 in. deep at center

Address all inquiries to Stock Mold Department, Modern Plastics, Chanin Building, New York, N. Y., giving item and sheet numbers. All molders are invited to send samples from stock molds to appear on this page as space permits

Sheets One to Fifty-Two reprinted in book form, twenty-five cents in coin or stamps

INDEX OF REFRACTION OF TRANSPARENT ORGANIC PLASTICS

THE COMPLETE TEXT OF THE METHOD FOR measuring the refractive index of plastics, developed by the Subcommittee on Optical Properties of A.S.T.M. Committee D-20 on Plastics, is presented herewith. This method was adopted as a Tentative Standard of the Society on June 28 at the annual meeting held in Atlantic City, New Jersey.

Scope

1. (*a*) These methods of test are intended for the measurement of the index of refraction of transparent organic plastic materials including cast, hot-molded and sheet materials.

(*b*) Two procedures, refractometric and microscopic methods, are proposed in order to satisfactorily cover the maximum range of indices found in these materials. The refractometric method is to be preferred wherever it is applicable.

Temperature Tests

2. All measurements should be made at a temperature of 25 ± 5 C. If a material is found to have a high thermal coefficient of index, the temperature shall be accurately controlled to 25 C.

Refractometric Method

Apparatus

3. The apparatus for the preferred method shall consist of an Abbé refractometer (Note 1), a suitable source of white light, and a small quantity of a suitable contacting liquid (Note 2).

NOTE 1.—Other suitable refractometers can be used with appropriate modification of procedure as described in Section 4 (*b*).

NOTE 2.—A satisfactory contacting liquid is one which will not soften or otherwise attack the surface of the plastic within a period of 2 hr. of contact. The index of refraction of the liquid must be higher, by not less than one unit in the second decimal place, than the index of the plastic being measured.

The following liquids are suggested:

Plastic	Contacting Liquid
Phenol formaldehyde resin	alphabromnaphthalene
Cellulose acetate and cellulose nitrate	cassia oil, aniseed oil, alphabromnaphthalene
Acrylic resins	saturated aqueous solution of zinc chloride made slightly acid
Vinyl resins[a]	alphamonobromnaphthalene
Styrene resins	saturated aqueous solution of potassium mercury iodide (Rohrbach's solution).[b]

[a] No liquid has been found to date which is entirely satisfactory for vinyl resins.

[b] Avoid contact of this liquid with the skin.

NOTE 3.—In many cases a liquid as suggested above is not available and a second rapid reading must be made on a fresh specimen after preliminary trial.

Test Specimen

4. (*a*) The test specimen shall be of a size such as will conveniently fit on the face of the fixed half of the refractometer prisms (Note 1). A specimen measuring 0.25 in. (6.3 mm.) by 0.5 in. (12.7 mm.) on one face is usually satisfactory.

(*b*) The surface to be used in contact with the prism shall be flat and shall have a good polish. A second edge surface perpendicular to the first and on one end of the specimen shall be prepared with a fair polish (Note 2).

NOTE 1.—For maximum accuracy in the refractometer method the surface contacting the prism shall be quite flat. This surface can be judged for flatness, provided the specimen has been satisfactorily polished, by observing the sharpness of the dividing line between the light and dark field. A sharp, straight dividing line indicates a satisfactory contact of the specimen and prism surfaces.

NOTE 2.—It has been found possible to prepare a satisfactorily polished surface by hand polishing small specimens on an abrasive material backed by a piece of plate glass. Fine emery paper (for example, No. 000 Behr-Manning polishing paper) followed by a polishing rouge suspended in water on a piece of parchment paper have been used as the abrasive.

Procedure

5. The hinged illuminating prism shall be removed from the refractometer, if necessary. A source of diffuse light shall be placed so that good illumination is obtained along the plane of the surface of the specimen with a drop of a suitable contacting liquid. This surface of the specimen shall be (*Please turn to page 78*)

[1] Under the standardization procedure of the Society, these methods are under the jurisdiction of the A.S.T.M. Committee D-20 on Plastics.

THE CLASSIFICATION AND CHEMICAL GENETICS OF ORGANIC PLASTICS

by GORDON M. KLINE

This concludes a series of articles, the first two of which appeared in our June and July issues. Publication is approved by the Director of the National Bureau of Standards of the U. S. Department of Commerce. (Editor's Note)

Natural Resinous and Bituminous Plastics

It is proposed to include under this heading not only the resins and bitumens which occur as such in nature but also the resinous masses which are prepared in the laboratory or factory by suitable chemical treatment of naturally occurring substances. Only two such sources of resinous masses will be discussed in this paper, namely, rubber and lignin.

1. *Natural Resins.* The natural resins used in plastics may be divided into two groups according to their sources, i.e., animal and vegetable. The only resin of industrial importance in the first group is shellac. This material is produced by an insect which lives parasitically upon certain species of trees in India and elsewhere in southern Asia. Studies of the chemical structure of shellac have indicated that it is the lactide condensation product of various complex hydroxy-carboxylic acids. Experimental work is in progress at lac research institutes on extracted shellacs, sulfur-treated lac, and lac combined with amines, aldehydes, polycarboxy acids, and phenols, the objective being to develop a thermohardening material or a thermoplastic modification with higher softening temperature. Large quantities of shellac are used in the manufacture of phonograph records, laminated paper insulators, and mica insulation products.

The principal natural resin of vegetable origin used in industry is rosin, which is the solid residue left after distillation of turpentine from crude pine resin. It consists largely of abietic acid, $C_{19}H_{29}COOH$, mixed with other complex terpenic acids and esters. It has not been used extensively in molding compositions because of its low softening point and brittleness. Rosin is esterified with glycerol to yield the product known as ester gum, and is used as a constituent of certain types of modified phenolic resins. These materials are commonly employed in varnish manufacture.

2. *Bituminous Plastics.* The bitumens consist of naturally occurring hydrocarbon complexes, which are insoluble in water but soluble in carbon disulfide and benzene. The solid or semi-solid bitumens containing only a small proportion of volatile constituents are now called asphaltic bitumens and have been referred to as the mineral resins. They are generally black in color, are hard at ordinary temperature, soften at about 70 deg. C., melt at about 100 deg. C. They are obtained from mineral deposits in various parts of the world, including many places in this country. Closely related to the bitumens are the tars and pitches which may be obtained naturally or are formed by the distillation of asphaltic petroleum. The chemistry of these bituminous substances is essentially a study of hydrocarbon compounds of high molecular weight, containing members of both the aliphatic and aromatic series. These materials are used in so-called cold-molded compositions, which are subjected to baking after molding to harden the pressed products by removal of solvent or by oxidation reactions. Battery boxes are usually made of these bituminous plastics combined with hard rubber.

3. *Resins Derived From Rubber.* Because of its unsaturated nature rubber readily reacts with many chemicals or undergoes self-polymerization or isomerization to yield products that are hard, dense resinous substances quite different in appearance and properties from ordinary vulcanized rubber. Many of these derivatives are thermoplastic and capable of being molded or extruded into finished products without the necessity of a further curing treatment. They are also soluble in common organic solvents, and useful, therefore, as coating materials for application by brushing or spraying. These rubber conversion products may be grouped into two main classes: addition products of rubber and isomerization products of rubber.

There are two addition compounds of rubber which are made commercially in this country, namely, chlorinated rubber and rubber hydrochloride. The chlorinated rubber has a chlorine content of about 60 to 65 percent, corresponding to between 6 and 7 chlorine atoms per $C_{10}H_{16}$. The chlorine is usually introduced into the rubber molecule by passing the gas into a solution of the masticated rubber in chloroform, benzene, or other suitable solvent. It has been suggested that the probable initial addition product, $C_{10}H_{16}Cl_4$, loses hydrogen chloride to form other unsaturated bonds which then take up further quantities of the halogen. Chlorinated rubber is produced as a powder having a specific gravity of 1.5. It is non-flammable and is said to be stable indefinitely at temperatures up to 100 deg. C. Chlorinated rubber is characterized by unusual resistance to acids and alkalies. It can be plasticized and molded, but its primary applications at present are in the protective coating field for use in preventing corrosion.

Hydrogen chloride adds to the double bond of the

rubber hydrocarbon to form $(C_5H_9Cl)_x$. The addition product containing 80 to 90 percent of the theoretically possible hydrogen chloride is useful as a film-forming material. The film is transparent, flexible, and tough, and resembles in appearance the well known wrapping films of the Cellophane type prepared from cellulose derivatives. It is finding a considerable market as a light-weight raincoat material, umbrella covering, and protective wrapping for foods.

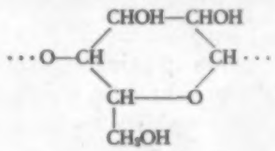
Treatment of rubber with aromatic sulfonic acids, sulfonyl chlorides, and halides of amphoteric metals, yields products varying from tough balata-like or leathery materials to hard brittle resinous substances. Chemical examination of these compounds has proved them to be isomeric with rubber. These isomers are readily soluble in hydrocarbons, have a density of about 1.0, softening temperatures of 55 to 105 deg. C., can be molded. Another type of commercial plastic is made by the reaction of rubber and chlorostannic acid, H_2SnCl_6. The resulting product is a chloroderivative of isomerized rubber. It has many potential applications in the coating and molding industries because of its pale color, inertness, and insulating properties.

4. *Resinous Plastics Derived From Lignin.* The utilization of waste wood, sawdust, and other lignin-containing materials for the production of molding compositions has been the objective of many investigations in recent years. Approximately 25 percent of wood is lignin, the exact structure of which is still undetermined, but known to vary with the species of tree and even with the age or portion of the tree from which it is obtained. The lignin molecule contains a number of hydroxyl groups, some of which are phenolic in character. In the preparation of molding compounds from natural products containing lignins it is not necessary to separate the lignin from the cellulose and other constituents which may be present. The Forest Products Laboratory found that several different types of chemical treatment of sawdust, for example, hydrolysis, chlorination, and esterification, will convert it into a powder which can be molded into sheets if the temperature and pressure used are high enough. However, they found it preferable to add aniline and furfural to the hydrolyzed sawdust in approximately equal proportions, about 6 to 8 percent of each giving the best results. The various reagents that have been used to react with lignin to form a plastic material may be classified under three general headings, i.e., phenols, amines, and aldehydes.

The low cost of these lignin plastics, estimated by various authorities as from one-fourth to one-tenth that of the usual phenolic molding materials, is offset to some extent by the longer molding cycle required. Their lack of resistance to moisture, tendency to swell and warp, and only partial curability are properties which for many purposes have made them inferior to the well-established phenol-formaldehyde resins. However, it is known that considerable experimental work has been carried on in industrial and government laboratories during the past few years on the production of molding compounds from lignin and many of these difficulties have been overcome or mitigated. The possible commercial applications of this type of plastic have just begun to be explored by its introduction on the market during 1937.

Cellulose Plastics

Cellulose, the chief sources of which are wood and cotton, is a polymer, of high molecular weight, of anhydroglucose in which the simple carbohydrate units are linked together by means of 1,4-glucosidic linkages. Each anhydroglucose unit contains three hydroxyl groups located in the 2, 3, and 6 positions, as indicated in the following diagrammatic formula:



in which the dotted lines represent the points of attachment of other units in the chain. Since the functional groups in cellulose are alcoholic in nature, the important derivatives are esters and ethers.

1. *Cellulose Nitrate.* The cellulose nitrate plastic is one of the oldest of the commercial plastics. Its industrial application dates back to about 1869. It is also commonly known as pyroxylin plastic, nitrocellulose (a misnomer since the compound is an ester and not a nitro derivative), and "Celluloid," although the latter term is only one of the many trade names for this type of plastic.

In the preparation of cellulose nitrate, purified cellulose is treated with nitric acid and a dehydrating agent such as sulfuric acid to take up the water that is formed. For plastics a nitrogen content of approximately 11.0 percent is desired, which corresponds to the reaction of about 2.0 hydroxyl groups per anhydroglucose unit with the nitric acid. After stabilizing the ester by boiling in dilute acid and then in water, it is mixed with solvents (alcohol or an alcohol-ether blend) and a plasticizer, for example, camphor. Dyes and pigments are added and the plastic mass is formed into sheets, rods, and tubes by suitable hydraulic presses and extrusion equipment.

Cellulose nitrate is a true thermoplastic material, that is, it softens when heated and hardens again when cooled. Its ease of molding, the many methods by which it may be worked, and the infinite variety of colors and mottled effects in which it may be obtained are important factors in its extensive use. The readiness with which parts may be cemented together or to other materials is also noteworthy. Its low ignition temperature and high rate of burning are, however, serious disadvantages. Pyroxylin plastics are used in the fabrication of combs and brushes of all kinds, hand mirrors, trinket boxes, ping-pong balls, fountain pen barrels, toys, and myriads of other articles in everyday use. Cellulose nitrate in a highly plasticized state is applied to cloth to yield artificial leather for bookbindings and upholstery.

2. *Cellulose Acetate.* Cellulose acetate is prepared by the esterification of cellulose with glacial acetic acid,

using some acetic anhydride to combine with the water formed during the reaction and a small amount of sulfuric acid to serve as a catalyst. In this instance it is found necessary to prepare the triacetate and to hydrolyze that compound to a product which is more suitable for use in plastics because of a greater solubility in common solvents and better thermoplastic behavior. The plastics type of acetate usually contains 36.5 to 38 percent of acetyl which corresponds to about 2.2 acetyl groups per anhydroglucose unit.

Cellulose acetate plastics resemble the nitrate products in physical properties, with the notable exceptions of flammability and stability. They burn very slowly and have a comparatively high ignition temperature. They are more resistant than the nitrate plastic to embrittlement and discoloration by aging, especially on exposure to sunlight. All ranges of color and light transmission from transparency through translucency to opacity may be obtained. The acetate plastics are more sensitive to water and undergo greater dimensional changes upon aging than does the cellulose nitrate type. Because of its stability at relatively high temperatures, cellulose acetate has proved to be well adapted to molding by injection, in which process the plastic must be brought to 300–400 deg. F. for a brief period. Resistance to impact of articles made from acetate plastic is responsible for many of its applications, such as protective goggles, oil cups and gauges, and handles for tools. Other major uses include automobile hardware, lamp shades, costume jewelry, and airplane windshields.

3. *Cellulose Mixed Esters.* Recently various mixed esters of cellulose have become available commercially, notably, cellulose acetopropionate and cellulose acetobutyrate. These are characterized by increased solubility in a wide range of common organic solvents and diminished water sensitivity as compared with the acetate alone. They have not as yet found extensive use in the manufacture of plastic compositions.

4. *Cellulose Ethers.* Various cellulose ethers have appeared on the market during the past few years, in particular, methylcellulose, ethylcellulose, and benzylcellulose. These ethers are prepared by treating alkali cellulose with alkylating agents such as alkyl halides and sulfates. The ethylcellulose products are of especial interest because of their solubility in a wide variety of solvents and their compatibility with many resins and waxes. They serve to raise the softening point and improve the toughness when mixed with these latter materials. Their possible outlets include plastics, films, and lacquers.

Protein Plastics

The fifth and final group of the organic plastics to be considered comprises the protein materials. The best known plastics of this type are those made from casein, which is obtained from milk, and a commercial soy bean meal molding composition containing a predominant percentage of phenol-formaldehyde resin. Other sources of protein raw material for plastics are being investigated, for example, zein from corn and alpha protein from soy beans. In practice formaldehyde is used for the purpose of converting these proteins into hard and stable compounds. Other substances, including chromium salts, alum, and tannic acid, can be used The exact nature of the reaction between formaldehyde and proteins is not known, but it presumably consists in a condensation of the aldehyde with the amino group in the protein. Because these materials take up considerable amounts of moisture at high relative humidities, they are in general unsuitable for outdoor use and for other applications which require dimensional stability and high electrical resistivity. They are used in the manufacture of buttons, buckles, beads, and various novelty articles.

Tabulations of Information on Plastics

Numerous summaries of information pertaining to the properties, methods of fabrication, uses and trade names of plastics have appeared in tabular form in the literature. Inasmuch as these tables are in most instances readily available in the original sources in this country, they will be merely cited rather than reproduced here or further tabulations of the same type prepared.

Data on the mechanical, optical, thermal, electrical, and permanence properties of plastics are presented in the following tables.

"Chart of Properties of Plastics—1938," Modern Plastics, Vol. 16, insert opposite page 172, October 1938 (Breskin and Charlton Publishing Corporation, New York City).

"Properties of Commercial Plastics," compiled by L. M. Currie, Handbook of Chemistry and Physics, 22nd Edition, pages 831–847, 1937–38 (Chemical Rubber Publishing Company, Cleveland, Ohio).

"Mechanical, Physical and Electrical Properties of Various Plastics," Lange's Handbook of Chemistry, 2nd Edition, pages 618–621, 1937 (Handbook Publishers, Incorporated, Sandusky, Ohio).

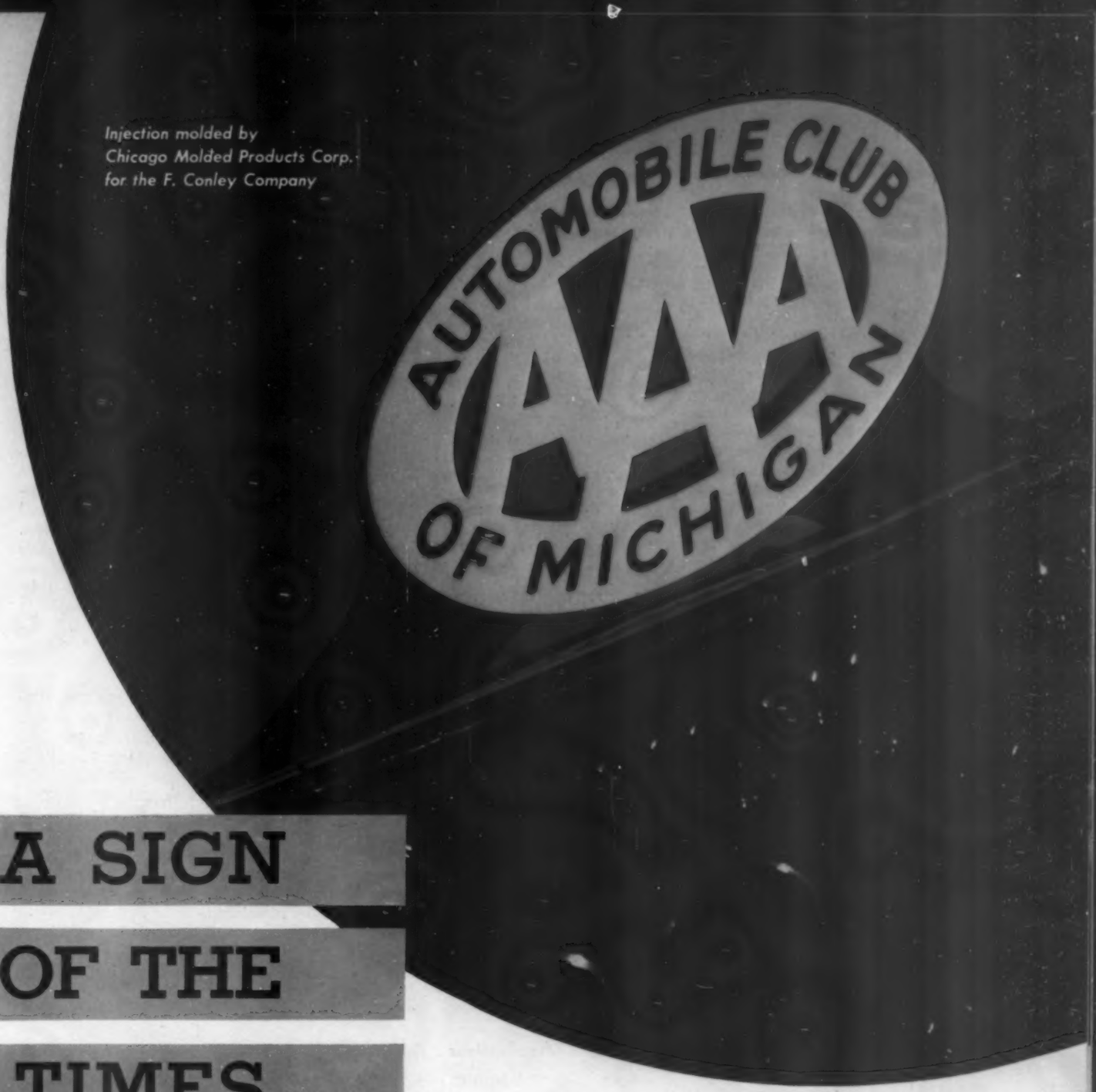
A table describing "Softening, Shaping and Hardening Agencies in the Manufacture of Plastics and the Fabrication of Articles from Plastics," prepared by A. F. Randolph was published on page 2 of the booklet of the American Society for Testing Materials, Philadelphia, Pennsylvania, entitled "Symposium on Plastics" (1938).

The principal uses of the various types of plastics have been tabulated in the following references.

"Properties of an Ideal Plastic," by A. F. Randolph. Table II lists "Important Characteristics and Fields of Uses of Plastics." Published as part of the "Symposium on Plastics" by the American Society for Testing Materials (1938).

"Plastics," by Herbert Chase. Table lists primary automotive applications. Published in Automotive Industries, Vol. 76, pages 722–730, May 15, 1937 (The Chilton Company, Philadelphia, Pa.).

"German Plastics and Their Essential Characteristics," translated by F. S. (*Please turn to page 82*)



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Plastics Digest

This digest includes each month the more important articles (wherever published) which are of interest to those who make plastic materials or use them

General

WHAT MOTOR CARS CAN BE. W. B. Stout. S.A.E. Journal *44*, 229–34 (June 1939). A searching analysis of motor car design of the past, present and future. The interior instead of the exterior, which is now emphasized, is the basic feature requiring study, passenger room having become less and less in recent years. It is predicted that the car of the future will have an interior that extends out the full width of the car with no running boards, totally inclosed wheels, unit frame and body, engine in the rear, and double or sliding doors. New body materials, such as plastics, are looked for on future cars to insulate them from the radiant heat of the sun, especially for roofs.

CASEIN FIBER. E. O. Whittier and S. P. Gould. Ind. and Eng. Chem. News Ed. *17*, 369–70 (June 10, 1939). A survey of the history and economics of the production of casein fiber. U. S. Patent 2,140,274 was issued to the authors for a fiber comprising casein, salts of casein, and fatty acids, and for a fiber in which the aluminum salt of casein is specifically claimed as a component.

SCHKOPAU BUNA WORKS. Kunststoffe *29*, 166–9 (June 1939). The first German plant for the manufacture of synthetic rubber is described. The process consists of converting acetylene, made from carbide, to acetaldehyde, to aldol, to 1,3-butylene glycol, to butadiene, to polymer.

UTILIZATION OF LACTIC ACID. L. T. Smith and H. V. Claborn. Ind. and Eng. Chem. News Ed. *17*, 370–1 (June 10, 1939). Lactic acid (alpha-hydroxypropionic acid) is available in large quantities as a fermentation product of lactose from skim milk and whey. Its carboxyl and alcoholic groups make possible the formation of dimetallic salts, ethers, esters, and various combinations of these derivatives. These compounds have potential applications as solvents, plasticizers, and sources of synthetic resins (polymethyl acrylate).

Materials and Manufacture

REACTANT MODIFIERS FOR RESINS. H. C. Cheetham. Can. Chem. and Process Ind. *23*, 163–5 (Apr. 1939). Chemical modification of alkyd resins for plasticizing purposes by means of inclusion of fatty acids and oils in the reaction mixture is well established. Copolymerization of various acrylic and methacrylic acid esters is another example of chemical plasticization. Urea-formaldehyde resins are toughened by reaction of butanol and other alcohols with the methylol groups. The crease-proofing of cellulose fibers with urea resins is probably another example of chemical modification. The methylol group of phenol resin intermediates can also be reacted with butanol to make thermosetting resins compatible with oil and capable of yielding tough, flexible films. If the alkyl group is attached to the benzene nucleus or the butanol reacts with the phenolic hydroxyl, resins which are thermosetting cannot be produced.

RECENT DEVELOPMENTS IN RUBBER POWDER. R. W. Parris. India Rubber World *100*, 41–2+ (Apr. 1939). Production of molding powders from rubber is discussed.

MELAMINE AND ITS POTENTIALITIES IN PLASTICS MANUFACTURE. Brit. Plastics *11*, 27–8 (June 1939). Melamine, a trimer of cyanamide, yields plastics which are distinguished by their glass-like clarity, hardness, and resistance to water. See *Plastics Digest* pages in Apr. and May 1939 issues.

STRUCTURE OF PHENOPLASTICS. M. Koebner. Brit. Plastics *11*, 7–9+ (June 1939). An enlargement of the chain molecules rather than a blocking of hydroxyl groups is considered to be responsible for the sudden transformation from solubility in alcohol and alkali to insolubility.

NICKEL AND MONEL EQUIPMENT. R. T. Barnes, Jr. Ind. and Eng. Chem. *31*, 847–9 (July 1939). Nickel, Monel, and Inconel have resistances to corrosion of high order in those reactions making use of alkyd, phenolic, and modified phenolic resins in varnish manufacture.

Applications

FOUR OUTSTANDING ACHIEVEMENTS. Brit. Plastics *11*, 10–13 (June 1939). Production of a full-sized coffin involved the development of a material, press, mold, and finally the molded box and lid. The press weighs 13,778 tons and has a ram capacity of 4,000 tons. A special phenolic resin composition was used.

PLASTIC TREADS FOR NEW ESCALATORS. Plastics *3*, 190–1 (June 1939). Nearly 20,000 molded slats are used for the treads of an escalator in the store of Harrods, Ltd., in England. Individual slats can be replaced when worn or damaged without incurring the cost of renewing the whole top of the step.

TRENDS IN THE DEVELOPMENT OF BUILDING MATERIALS. M. Lowenthal. Arch. Record *85*, 78–83 (May 1939). A trend is seen toward the development of materials that meet both structural and surfacing needs and toward shop fabrication of finished members. The applicability of plastics to these problems is surveyed.

PLASTIC ROLL NECK BEARINGS. Plastics *3*, 178–81 (June 1939). The experiences of a German steel mill which equipped their rolling mills with bearings molded of reinforced phenolic plastics are described. The general conclusion reached is that with suitable precautions regarding the design, position, and lubrication of the bearings, both hot and cold rolling mills can advantageously switch over from metal to plastic bearings.

RESIN-TREATED PLYWOOD. A. J. Stamm and R. M. Seborg. Ind. and Eng. Chem. *31*, 897–902 (July 1939). Veneers for plywood manufacture were treated with synthetic-resin-forming materials to minimize shrinking and swelling of the finished product. Phenol-formaldehyde-catalyst intermediates that are but slightly polymerized and are soluble in water give the best results. Urea-resin intermediates are but slightly effective, whereas vinyl, styrene, glyceryl-phthalate and methyl methacrylate resin-forming materials gave but little reduction in the swelling and shrinking of wood.

Testing

OPTICAL TESTING OF PLASTIC SURFACES. H. Klingelhöffer and H. Müller. Kunststoffe *29*, 14–7 (Jan. 1939). Irregularities of surfaces are measured by reflected light.

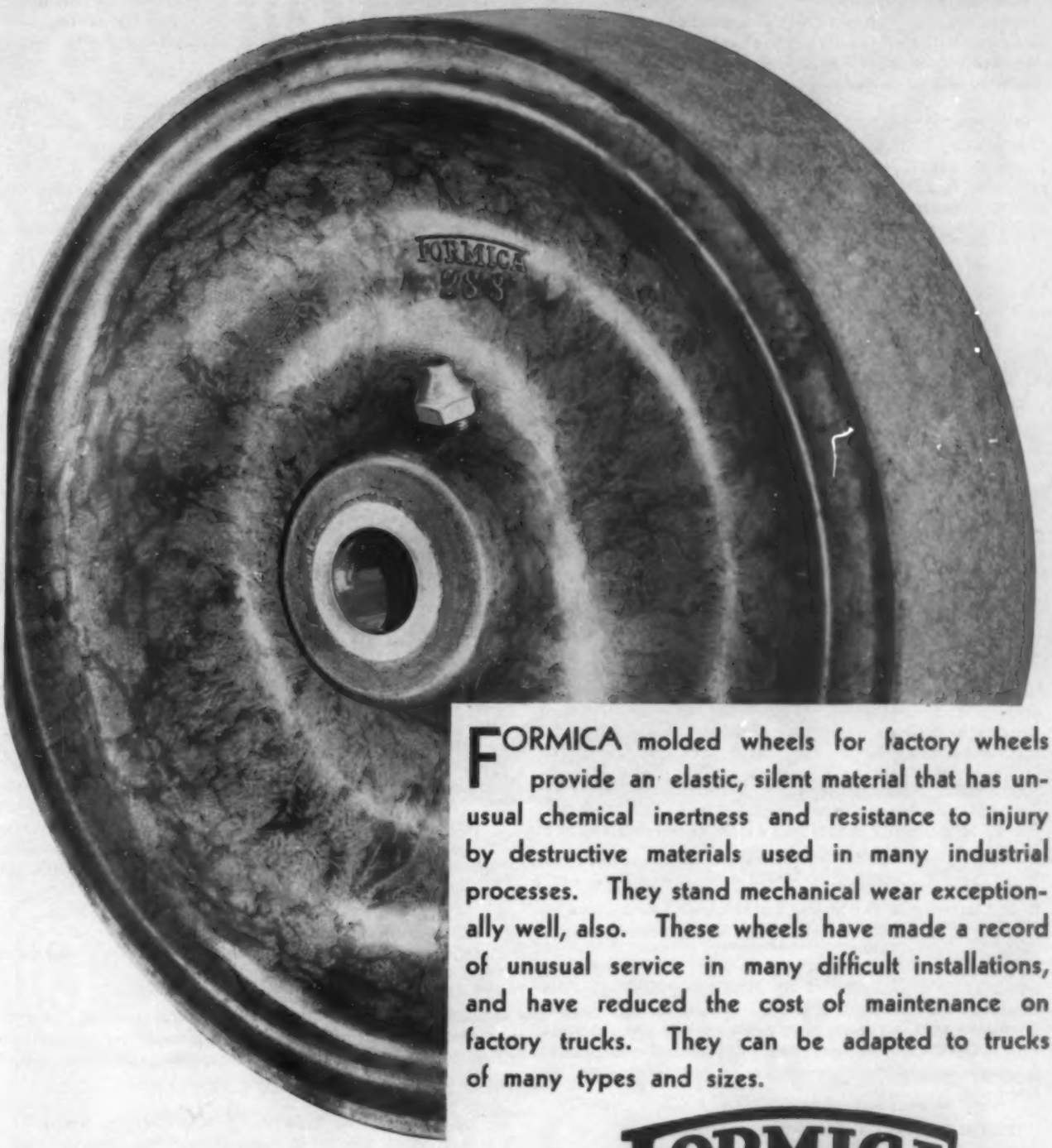
RESISTANCE OF PLASTICS TO WATER. M. de Buccar. Rev. Gen. Mat. Plastiques *15*, 93–5 (Apr. 1939). General discussion, followed by a description of a method for determining the relative permeability of plastics to water by means of fluorescent indicators sensitive to moisture. Water is placed in contact with one surface of the plastic, the indicator sprinkled on the other surface and the time required for the color change is noted, using ultraviolet light.

Coatings

DRYING WITH NEAR INFRA-RED RADIATION. L. S. Ickis, Jr., and H. Haynes. Gen. Elec. Rev. *42*, 145–9 (Apr. 1939). The drying lamp with 10,000 to 20,000-hour life has a light output of about one-third that of a conventional Mazda filament lamp at comparable wattage, most of the energy being delivered in the invisible wave lengths. Near infra-red drying affords flexibility of plant construction and a saving of space. Heat control is positive, flexible, and requires no warming-up period. The radiant drying banks need be neither force ventilated nor insulated.

SCIENCE SAVES THE SURFACE. R. J. Moore. Aero Digest *33*, 106+ (July 1939). The outstanding features of phenolic resin finishes are their speed of drying, durability, water and chemical resistance and retention of flexibility. Various types of these finishes used on aircraft and for other applications are described.

FORMICA WHEELS
-FOR FACTORY TRUCKS!



FORMICA molded wheels for factory wheels provide an elastic, silent material that has unusual chemical inertness and resistance to injury by destructive materials used in many industrial processes. They stand mechanical wear exceptionally well, also. These wheels have made a record of unusual service in many difficult installations, and have reduced the cost of maintenance on factory trucks. They can be adapted to trucks of many types and sizes.

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U. S. Plastics Patents

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 10 cents each

RUBBER-LIKE POLYMERS. P. J. Gaylor (to Standard Oil Development Co.). U. S. 2,160,995-6-7, June 6. Plastics which are resistant to oxidation and to acids are made by blending polyisobutylene with a polyethylene sulphide resin, with a vinyl chloride:vinyl acetate polymer or with polymerized chloroprene.

VINYL RESIN COATINGS. A. K. Doolittle (to Carbide and Carbon Chemicals Corp.). U. S. 2,161,024-5-6, June 6. Coating hard rubber articles with a firmly adherent baked film of vinyl chloride: vinyl acetate resin; slow-drying brushing lacquers containing nitrocellulose blended with vinyl chloride:vinyl acetate resin; and stabilizing vinyl resins to light by adding 3-30% antimony oxide.

RUBBER-LIKE POLYMERS. B. J. Habgood and L. B. Morgan (to Imperial Chemical Industries, Ltd.). U. S. 2,161,038-9, June 6. Making artificial rubber by interpolymerization of butadiene with a methacrylate of a monoalkyl or monoaryl ether of ethyleneglycol, or with a monochlorinated methacrylate ester.

TRANSPARENT FOILS. Wm. C. Calvert (to Wingfoot Corp.). U. S. 2,161,454, June 6. Making transparent foils from rubber hydrochloride in benzene solution.

PROPELLER BLADES. M. Scholz and A. Wagenitz (to Hugo Heine). U. S. 2,161,533, June 6. Metal reinforcement for wooden propeller blades is cemented to the wood with a permanently elastic adhesive containing a heat-hardenable resin in alcohol saturated with boric acid.

HYDROCARBON RESINS. C. C. Towne (to Texas Co.). U. S. 2,161,599, June 6. Polymerizing petroleum unsaturates in presence of anhydrous metal halides to form resins.

LIGNIN MOLDINGS. N. N. T. Samaras and M. Plunguian (to Mead Corp.). U. S. 2,161,748-9, June 6. Making low-melting molding compositions, suitable for coating and fluxing the surface of fibrous materials, by heating a lignin product (melting at about 220-230° C.) with steam or with furfural.

SYNTHETIC FIBER. E. W. Rugeley, T. A. Feild, Jr., and J. F. Conlon (to Carbide and Carbon Chemicals Corp.). U. S. 2,161,766, June 6. Making textile threads from a clear, viscous dispersion of a vinyl chloride: vinyl acetate resin in acetone.

SPIRIT-SOLUBLE RESIN. Wm. H. Carmody (to Neville Co.). U. S. 2,161,951, June 13. Making a colorless spirit-soluble resin by polymerizing the unsaturates of solvent naphtha in presence of a phenol, and hydrogenating the product.

PROTECTIVE LACQUER. I. E. Muskat (to Pittsburgh Plate Glass Co.). U. S. 2,162,027-8, June 13. Protecting metal containers from alkali by coating on the inside with a cellulose ether plasticized with an alkylnaphthalene, and plasticizing pigmented cellulose ether lacquers with diamylnaphthalene so that the film will be tough, adherent and impermeable.

THERMOPLASTIC. F. Seebach (to Bakelite Corp.). U. S. 2,162,035, June 13. Milling a phenol-aldehyde (novolak) resin with water and hexamethylenetetramine on hot rolls (110°C.) to raise the melting point, drying and remilling the resin without insolubilizing it.

NON-YELLOWING RESIN. H. Hönel and A. Zinke (to Reichhold Chemicals). U. S. 2,162,172, June 13. Condensing formaldehyde with an alkylcycloalkylphenol.

COATED WIRE NAILS. E. W. D. Laufer and C. P. Reis (to American Steel and Wire Co.). U. S. 2,162,177, June 13. Coating nails with a pyroxylin and resin lacquer to increase holding power (friction between nail and wood).

X-RAY SHIELD. M. Marasco and E. A. Meritt (to Du Pont Film Mfg. Corp.). U. S. 2,162,178, June 13. A plastic shield material for X-rays is made of lead powder in a plasticized polyvinyl acetate binder.

MAGNETIC CORES. W. Schulze (to Allgemeine Elektricitäts-Gesellschaft). U. S. 2,162,273, June 13. Particles for magnetic induction cores are sheathed in two thin insulating films, one of amber and one of polystyrene resin.

FAST DRYING INK. C. Ellis (to Ellis Laboratories, Inc.). U. S. 2,162,331, June 13. A quick setting printing ink is made from a pigmented heat-reactive aminoplast resin and a liquid vehicle.

SHATTER-PROOF WINDOWS. Harry N. Atwood. U. S. 2,162,598, June 13. Encasing glass ribbons in a transparent plastic, interweaving the ribbons in a lock weave, facing both sides of the resulting sheet with a transparent plastic and subjecting the assembly to heat and pressure.

ABRASIVES. A. L. Ball (to Carborundum Co.). U. S. 2,162,600, June 13. A resin-bonded abrasive having diamond particles surrounded by smaller metal particles.

ALDEHYDE RESIN. W. O. Herrmann, H. Deutsch and B. von Zychlinski (to Chemische Forschungsgesellschaft m. b. H.). U. S. 2,162,616, June 13. Catalytically condensing an aldehyde with itself, and hydrogenating the resinous product.

POLYVINYL ACETALS. H. F. Robertson (to Carbide and Carbon Chemicals Corp.). U. S. 2,162,678-9-80, June 13. Making tough, strong resins by acetalizing polyvinyl alcohol to the extent of 54-78% with butyraldehyde, or 62-88% with propionaldehyde, or 39-58% with valeraldehyde; and plasticizing the products with triethyleneglycol di-(2-ethyl butyrate).

LINOLEUM SUBSTITUTE. D. H. Spitzli and R. L. Kennedy (to Congoleum-Nairn, Inc.). U. S. 2,162,924, June 20. Compounding chlorinated rubber with a partially bodied oil to make a linoleum-like product.

RECOVERING GOLD. H. Burrell (to Ellis-Foster Co.). U. S. 2,162,936, June 20. Recovering gold from solutions by absorption on particles of an acid-condensed polyhydric phenol resin.

INSULATED WIRE. R. B. Lattin (to Rockbestos Products Corp.). U. S. 2,162,953, June 20. Flexible, flameproof, water-repellent insulation for electric conductors comprises compacted asbestos impregnated with a phenolic resin and chlorinated diphenyl.

SELF-HARDENING PLASTIC. J. A. Kenney (to Barrett Co.). U. S. 2,163,243, June 20. A plastic comprising paracoumarone resin, chlorinated rubber, a solvent and sufficient filler to impart a putty-like consistency.

FUSIBLE RESIN. O. Süssenguth (to Bakelite G. m. b. H.). U. S. 2,163,264, June 20. Effecting urea-formaldehyde condensations in presence of phenol-formaldehyde resins at 15-35°C.

Which INJECTION MOLDING PRESS BEST FITS MY PRODUCTION NEEDS?

The major question confronting every plastic molder about to install a new press is, "Which press will give me dependable service . . . anticipate my production needs both today and tomorrow?" • The answer lies in an H-P-M INJECTION MOLDING PRESS – and here are the reasons why.

H-P-M INJECTION MOLDING PRESSES incorporate all of the major developments and improvements that time and experience have proven to be practical and sound. These include: the HYDRO-POWER Operating System – the independent press drive which makes each press a reliable self-contained machine and provides complete control over every press movement; smooth, speedy hydraulic action; the exclusive H-P-M Injection Unit which may be used individually or in multiples; and many other features.

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HPM INJECTION MOLDING PRESSES

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Foreign Plastics Patents

Application dates are given for patents of European countries, but for Canada the issue date is given

HOLLOW ARTICLES. Kurt Bratring. German P. 665,837, Jan. 17, 1935. Hollow articles are formed from cellulose acetate, viscose or synthetic resin solutions by dipping, using a mold lubricated with talc or glycerol, and coated with rubber or an elastic polymer to facilitate stripping the hollow article from the mold by inflation.

CABLE JACKET. Felten und Guilleaume Carlswerk Akt.-Ges. French P. 833,290, Feb. 4, 1938. A cable jacket is composed of several windings of aluminum foil coated with polyvinyl chloride, and a final outer film of polyvinyl chloride.

SAFETY GLASS. M. Müller-Cunradi, M. Otto, W. Daniel and R. Werner (to I. G. Farbenindustrie Aktiengesellschaft). German 668,000, July 9, 1933. Use of highly polymerized isobutylene as interlayer in safety glass.

TABLEWARE. I. G. Farbenindustrie Aktiengesellschaft. French P. 831,827, Jan. 10, 1938. Kitchenware, tableware and sanitary goods which must not be affected by boiling water, are made of resins formed by condensing formaldehyde with melamine, ameline, diaminoquinazoline or the like.

RESIN FILMS. Allgemeine Elektricitäts-Gesellschaft. German P. 667,416, Aug. 28, 1936. Heat-hardenable synthetic resin films are made by spraying a liquid (e. g., alkyd) resin on an endless moving metal belt, coated thinly with mercury, heating to set the resin, and stripping the film from the belt.

RESOLS. Richard Hessen (to Aug. Nowack Aktiengesellschaft). German P. 669,902, March 28, 1930. Vaporizing the volatile components of soluble, fusible resols by flash heating (e. g., 30–45 seconds on a hot plate at 200°C.), without converting them to resitol or resite products, to produce non-tacky, non-agglomerating resins.

HOT-PRESSED COATINGS. Plaskon Co., Inc. French P. 833,811, Feb. 16, 1938. Impregnating paper or sawdust with a thermosetting urea-formaldehyde resin, drying, grinding, suspending the powder in a liquid vehicle, coating any suitable surface therewith, drying, and hot-pressing to a smooth, glossy coating.

GREASEPROOF PAPER. Oskar Lang. French P. 834,220, Feb. 24, 1938. Waterproof, greaseproof paper closely resembling parchment paper is made by adding a vinyl resin or polyacrylate ester, plasticized with a dialkyl phthalate or adipate, to the pulp before forming the paper web.

COATINGS. Dynamit-Aktiengesellschaft vormals Alfred Nobel & Co.). French P. 833,335, Feb. 7, 1938. Thermoplastic polymers of styrene, vinyl chloride, isobutylene or acrylic acid derivatives are applied in warm solution (50°C.) to preheated fabric to increase penetration, thereby improving anchorage of resin to fabric and accelerating the drying of the solution.

MIXED POLYMERS. I. G. Farbenindustrie Aktiengesellschaft. French P. 831,438, Dec. 29, 1937. Interpolymerization of butadiene with vinylacetylcarbinols gives vulcanizable rubber-like products which are insoluble in organic solvents.

ARTIFICIAL LEATHER. W. W. Groves (to Deutsche Celluloid-Fabrik). British P. 498,742, June 8, 1937. Plasticized vinyl resins are passed through a hot goffering calender, one roll being smooth and the other carrying the desired grain, e. g., to imitate pigskin.

GLASS FIBER PRODUCTS. A Neumann. British P. 498,822, July 10, 1937. Making containers, lamp shades, vases, statues and other articles in ornamental translucent effects by use of glass fiber with a cellulose derivative binder.

DENTURES. S. W. Wilding (to Amalgamated Dental Co., Ltd.). British P. 498,877, July 12, 1937. Making artificial dentures from a mixture of polystyrene and polymerized methyl methacrylate.

ELECTRICAL INSULATION. Felton & Guilleaume Carlswerk Aktiengesellschaft. French P. 835,234, March 14, 1938. Plasticizing polystyrene with non-polar substances, e. g. polyisobutylene, so that favorable dielectric properties are not sacrificed.

SOUND RECORDS. Telefunkenplatte G. m. b. H. French P. 833,389, Feb. 8, 1938. Coumarone resin, with or without a vinyl resin to add strength, is used as binder in sound record disks.

FLOOR COVERING. I. G. Farbenindustrie Aktiengesellschaft. French P. 835,729, March 25, 1938. Interpolymers of vinyl ethers, some derived from monohydric and some from polyhydric alcohols, are milled and applied to a jute backing to make a highly waterproof floor covering.

INJECTION MOLDINGS. I. G. Farbenindustrie Aktiengesellschaft. German P. 671,631, July 2, 1936. Highly heat-resistant injection moldings are made from polyvinylcarbazole resins containing not more than 25% filler.

RODS AND TUBES. Peter Kopp. German P. 671,557, Jan. 18, 1933. Metal-reinforced rods or tubes are made by applying a tube of hot hardenable synthetic resin over a cold metal rod or tube so that the resin shrinks and is firmly bonded to the metal.

HOLLOW ARTICLES. Camille Dreyfus. Can. P. 380,268, March 21. In making hollow shaped articles from thermoplastic cellulose derivatives a thin glass core is covered with the thermoplastic; the core is subsequently shattered and removed. For gloss finish the surface of the article is polished by solvent action.

LUMINESCENT RESINS. G. Zeiler and F. Münzel (to Soc. Anon. Invex). French P. 836,321, April 7, 1938. Resin condensations are effected in presence of oxidizing agents, e. g., a pyrogallol-formaldehyde condensation in presence of hydrogen peroxide. The initial chemiluminescence disappears but the product still emits dark rays, similar to soft X-rays, for several weeks. Similarly, resinification of tung oil with benzoyl peroxide excites a visible luminescence.

IMPROVING TARS. I. G. Farbenindustrie Aktiengesellschaft. Swiss P. 199,639, Aug. 6, 1936. A very small proportion (less than 1%) of added polyvinyl acrylate greatly improves the binding power of tars and like bitumens.

Grab yourself a chair!

and pull up at the busiest conference on industrial advertising you ever heard of.

Two hundred controversial subjects will be discussed in clinics large and small. "How to improve your effectiveness as an advertising manager" will be one of the large clinics. The first day is Executive's Day (bring your boss).

Even at lunches you will be grouped with members and guests having identical interests.

Take advantage of low transportation rates, hotel accommodations at no increased cost and a guided tour of the industrial exhibits at the World's Fair with a day and a half left over to yourself! Make your hotel reservations early!

Some of the Clinic Subjects

FIELD WORK	PUBLICITY
PERFORMANCE DATA	MARKET DATA
DIRECT MAIL	MEASURING RESULTS
INDUSTRIAL EXHIBITS	CATALOGS
READERSHIP VALUES	SALES MANUALS

TIE-UP WITH SALES FORCE

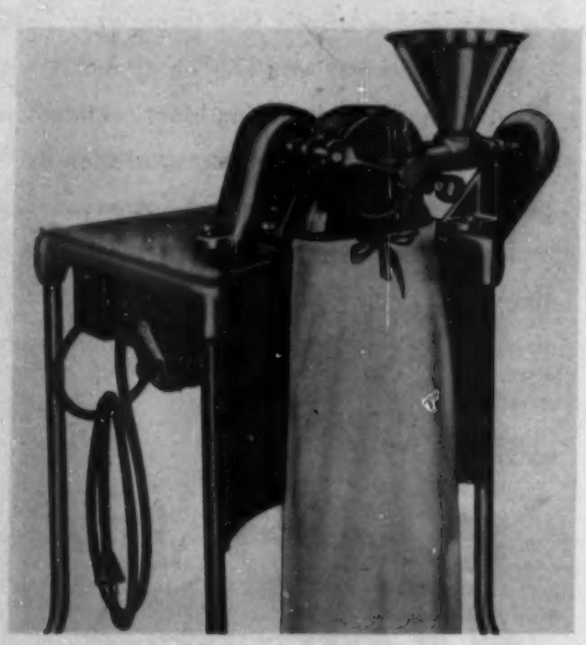
EXHIBITS
•
AWARDS
•
LADIES' PROGRAM
•
DINNER AND SHOW AS USUAL

National Industrial Advertisers Association
100 East Ohio Street **Chicago, Illinois**
2-39

Equipment

MORE ACCURATE TIMING OF INDUSTRIAL PROCESSES IS made possible by an improved Signal-Graph, according to Production Instrument Co., manufacturers. In operation, it automatically measures and records, on a chart calibrated in minutes, processing periods, loading or inactive time and also signals the operator when the set processing time has elapsed. This model is controlled by an electric switch and may be placed at any distance from equipment.

EASY ELECTRIC SANDER, PORTABLE ALL-ELECTRIC RECIPROcating motion sanding, rubbing and polishing machine has been introduced by Detroit Surfacing Machine Co. It is adaptable for applications on flat, curved, and irregular surfaces, permits one-handed operation, weighs 6¼ lbs. Ball-bearing construction, forced ventilation cooling, dust-proof parts, and complete standard accessory equipment insure efficiency for heavy duty or precision work.



SMALL PULVERIZING JOBS CAN BE HANDLED ECONOMIcally, it is claimed, on the new Bantam portable pulverizer (above) announced by Pulverizing Machinery Co. The company has manufactured Mikro-Pulverizers for the past 16 years and the new Bantam has been brought out to handle jobs which were not practical with the larger equipment. The new mill has been given long, grueling tests on many materials and it is felt it will fill a real need in the plastics field.

RIETZ DISINTEGRATORS FOR REDUCTION OF DRY OR WET material, hot or cold, sticky or gummy services are supplied by Process Machinery Co. This series, essentially vertical hammer mills, with rotor and screen assemblies designed for control of "fines" and close adherence to screen analysis specifications, is applicable to fine mixing in a continuous process in place of standard batch operations. Bulletin along with sample of representative products is obtainable.

MODEL F-O, NEW SMALL MODEL VIBRATORY FEEDER ANnounced by Syntron Co., intended for small finely controlled feeds, provides a finger-tip control of the rate of flow of solids with an entire absence of moving and wearing parts, such as motors, screws, belts, disks, etc. Sheet metal trough, 18 in. by 3 in. with tapered sides, mounted on springs and actuated by pulsating electro-magnet is regulated by separate rheostat controller.

Publications

Write for these booklets. Unless otherwise specified, they will be mailed without charge to executives who request them on business stationery. Other books will be sent postpaid at the publishers' advertised prices.

An Introduction to the Chemistry of Cellulose

by J. T. Marsh and F. C. Wood

D. Van Nostrand Co., Inc., 250 Fourth Ave., New York, 1939
Price $7.50 **431 pages**

Cellulose is a subject which is quite often dismissed in textbooks of organic chemistry with a statement that it is a complex polysaccharide of the general formula $(C_6H_{10}O_5)_n$, the n having the usual meaning that nothing much is known about the compound. However, Marsh and Wood set out to prepare an "elementary" account of our present knowledge of cellulose for graduating chemists who are entering industries concerned with this material and finished with a sizable book of over 400 pages. At that, scant mention is made of the uses of cellulose derivatives in plastic compositions, but this subject would require a separate book for adequate treatment. In general, the subject matter is presented in a very factual style, which, while it makes heavy reading for a purportedly simple book, increases its usefulness as a source of valuable information.

The book is divided into five parts which treat of (1) the occurrence and general properties of cellulose, (2) dispersed cellulose, (3) modified cellulose, (4) derivatives of cellulose, and (5) constitution and structure of cellulose. The recent literature on these various phases of cellulose chemistry is thoroughly considered. An astonishing variety of cellulosic compounds is described in Part 4. The student may feel the lack of a carbohydrate-coating in the manner of presentation, but we can recommend this book as an excellent reference work on the chemistry of cellulose and its derivatives. G. M. K.

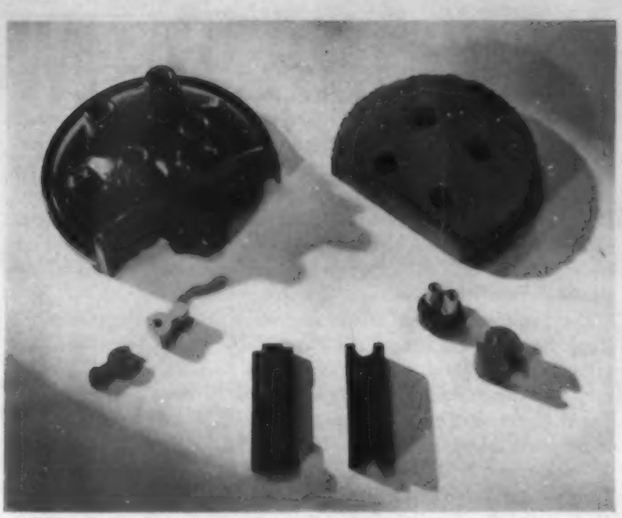
A POCKET-SIZE 82-PAGE HANDBOOK OF TECHNICAL DATA has been prepared by the Plaskon Co., Inc., Toledo, Ohio, for manufacturers, engineers, designers, etc., in the plastics industry. Various sections, illustrated with photos, graphs and line drawings cover the various properties of the material and its physical constants; essential principles of plastic design, molding technique, forms and plasticity types; common molding difficulties; die construction; preforming; storage and handling; preheating, tests for cure and fusion, etc. A complete appendix includes laboratory reports, definitions of physical and electrical terms, and various standard formulas, rules, and tables of important related and general technical information.

THE FIRST ISSUE OF AN ILLUSTRATED PERIODICAL "PLASTICS Bulletin," giving news of developments of plastics and their applications, has been published by the Plastics Department of E. I. du Pont de Nemours & Co., at Arlington, N. J. The bulletin is 8⅓ by 11 inch sheet size, in a 4-page leaflet form with margin perforations for filing in a loose-leaf notebook, and is printed in two colors.

TO CELEBRATE THE FIFTIETH ANNIVERSARY ON JUNE 1, 1939, of its founding, the Carpenter Steel Co., Reading, Pa., has issued a 36-page illustrated booklet, "Fifty Years of Progress," a historical sketch, by Earl M. Brumbach, Wire Mill Inspection Department.

THE RESULTS OF AN EXTENSIVE RESEARCH ON INDUSTRIAL progress and the relation of machines, tools and inventions to employment promotion by Leighton A. Wilkie, president of Continental Machines, Inc., Minneapolis, Minn., are embodied in a graphic, illustrated "pictograph" chart, 21½ in. high by 58 in. long, titled *Machines and Progress*. Copies at $1.00 each are available from the company.

REVOLVING TYPE, FLEXIBLE BALL JOINTS, WHICH PROVIDE movement in all directions in connecting fixed piping to revolving drums or other revolving apparatus are described by Barco Manufacturing Co., 1801 Winnemac Ave., Chicago, in a recent bulletin.



Preformed

FOR PERFECTION

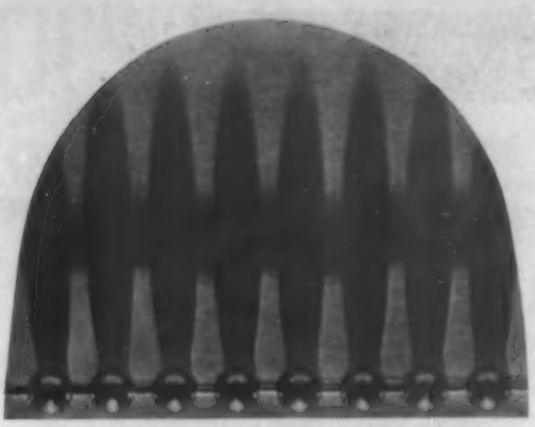
Perhaps you never have seen plastic parts actually molded. That's why we show you above the preforms that precede the actual molding operations together with the finished parts.

The right shape and amount of molding compound insures economical manufacturing. Too little causes "shorts" or unfilled pieces that are rejected. Too much causes excessive fins that raise finishing costs.

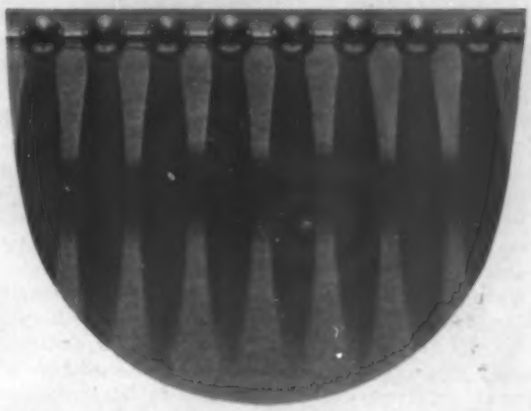
That's why Auburn's more than 60 years of experience applied to such details gives you the most for your money. A trial order will show you just what that means to you.

Established 1876

MOLDED PLASTICS DIVISION OF
AUBURN BUTTON WORKS, Inc.
AUBURN, N.Y.



INGENUITY



BEAD CHAIN*

Because of the perfect swiveling action of every connecting link, BEAD CHAIN* is particularly desirable for any use where curved surfaces, moldings or projections of a product interfere with the free flow or swing of a chain.

BEAD CHAIN*, too, in its variety of natural, polished and plated finishes of many metals, including Monel, adds a decorative note to any modern product.

Our engineering department is prepared to cooperate with manufacturers and designers to develop effective assemblies for specific needs of operation or appearance. Bead diameter sizes from 3/32″ to 3/8″.

BEAD CHAIN
ESTABLISHED 1914
Trade Mark Reg. U.S. Pat. Off.

THE BEAD CHAIN MANUFACTURING CO.
60 MT. GROVE ST. BRIDGEPORT, CONN.
* Reg. U. S. Pat. Off.

NEWS

GATHERINGS OF BUSINESS EXECUTIVES, STUDENTS, ENGINEERS and designers can be delightfully entertained for twenty minutes by a showing of the sound and color film, *Modern Plastics Preferred*, which is available without cost through the Publicity Department of the magazine. This film, devoid of all propaganda, reveals the source of plastic materials, follows them through various stages of their fabrication into commercial products, and finally, pictures the most unusual and effective application of plastics as represented by the winners in our last Modern Plastics Competition. Educational as well as entertaining, this film is open for Fall bookings. Write for open dates and incidental information to Publicity Director, Modern Plastics, 122 East 42nd St., New York, N. Y.

THE RESEARCH CONFERENCE ON "RESINOUS POLYMERS" during the week of July 10 at Gibson Island, Maryland, arranged by Dr. Neil E. Gordon under the sponsorship of the Chemistry Section of the American Association for the Advancement of Science, proved to be as popular as the similar meeting held there in 1936. The housing facilities of the Club were completely filled and many of the group overflowed into nearby Baltimore, Annapolis, and Riviera, and one hardy soul commuted each day from the Army-Navy Club in Virginia. Dr. Baekeland was unable to be present and a telegram was sent to him by the group expressing their regret at his absence and their hope for a speedy convalescence from his recent illness.

The scientific sessions were marked by several exceptionally thought-provoking papers and by the searching and constructive discussions which followed the remarks of each speaker. Dr. Bender, chairman of the meetings, received a well-earned acclaim for his successful efforts in arranging a balanced program and for the skill and timely humor shown in ferreting out worthwhile details in the question periods. Inasmuch as the purpose of these conferences is to promote a maximum exchange of ideas in a very informal atmosphere, no record of the proceedings is available for publication.

Dr. H. L. Bender in his paper on "The Physical Viewpoint of Resinous Polymers as to Size and Linkage" succeeded in arousing plenty of argument as to the respective importance of physical structure and chemical linkages in the resinous state. Dr. R. H. Kienle in discussing the "Infusible Resinous State" presented further evidence of definite stages in alkyd resin formation, leading up to the sol-gel transition zone. Dr. S. S. Kistler spoke of "Conditions for Infusibility" and emphasized the important role which shearing forces between large and small molecules plays in determining relative fusibility. Dr. S. D. Douglas described the preparation and various applications of the "Resinous Vinyl Compounds" and Dr. Ivey Allen in presenting his paper on "Polystyrene" exhibited samples showing the transformation of this resin from a granular to a glassy state and vice versa under the influence of heat. Dr. G. M. Kline in discussing "Electronic Structure and the Behavior of Cellulose Compounds" presented experimental data on the relative susceptibility of various cellulose esters to dimensional changes in the presence of moisture and propounded an explanation for the observed behavior based on hydrogen bridges between hydroxyl groups and oxygen atoms linked to other atoms by semi-polar bonds. Dr. C. S. Marvel in speaking on "The Structure of Some Vinyl Polymers" gave examples of some 1,2-1,4 and 1,3 or head to head-tail to tail and head to tail reactions and emphasized that the formation of these resins appears to be an orderly process, following one or the other of the above schemes and in no case yet studied being a random mixture of the two types of reactions. Dr. R. B. Barnes talking on "Spectroscopy and Resin Structure" reviewed the potential and actual applications of infra-red absorption spectra data in helping to elucidate the processes of resin formation. Dr. P. J. Flory in his paper on "Viscosity and Constitution of High Molecular Weight Substances" presented data on the relationship between viscosity, temperature, and molecular weight of certain resins, and discussed the bearing of molecular weights calculated on average particle size and particle number bases, respectively, upon such studies as these mentioned.

Possible subjects for future conferences in this field were discussed before adjourning; these included "Chemistry of Cellulose and Its Derivatives," "Kinetics of Resin-Forming Reactions," "Resinous and Elastic Polymers," and "High Molecular Weight Compounds." Drs. Kienle, Kistler, and Bender were appointed as members of a steering committee to select a suitable topic for the next conference and to formulate the necessary plans for housing the group as conveniently as possible. Dr. Gordon was given a rising vote of thanks for his unselfish contribution of time and energy in planning this conference and taking care of the many details incident to such an undertaking.

The list of registrants at the conference included the following: Hoag, American Can Co.; R. B. Barnes, E. L. Kropa, American Cyanamid Co.; E. R. Moulton, American Optical Co.; P. O. Powers, Robinson, Armstrong Cork Co.; L. T. Sutherland, Barrett Co.; Ivey Allen, Jr., H. L. Bender, E. R. Hanson, J. Schmidt, Bakelite Corp.; C. S. Fuller, Bell Telephone Lab.; R. H. Kienle, Calco Chemical Co., Inc.; A. W. Downes, S. D. Douglas, F. W. Duggan, C. E. Staff, Carbide and Carbon Chemicals Corp.; B. Andersen, R. H. Ball, Celluloid Corp.; N. E. Gordon, Central College; E. C. Pfeffer, Continental Can Co.; J. T. Stearns, E. Ward, Jr., Dept. of Agriculture; N. S. Grace, Dunlop Rubber, Canada; Arnold, Blake, Kenney, Migdon, E. I. du Pont de Nemours & Co.; R. M. Fuoss, General Electric Co.; Emil Ott, Scrutchfield, H. M. Spurlin, Hercules Powder Co.; E. E. Reid, Johns Hopkins Univ.; J. K. Simons, G. H. Young, Mellon Institute; F. H. Murdock, Monsanto Chemical Co.; G. M. Kline, National Bureau of Standards; S. S. Kistler, Norton Co.; W. H. Lycan, Pittsburgh Plate Glass Co.; A. G. Hovey, Reichhold Chemicals, Inc.; G. O. Morrison, Shawinigan Chemicals, Ltd.; P. J. Gaylor, Gleason, E. H. McArdle, Standard Oil Development Co.; E. R. Littman, Stanco, Inc.; R. T. K. Cornwell, Sylvania Industrial Corp.; P. J. Flory, Univ. of Cincinnati; C. S. Marvel, Univ. of Illinois; R. W. Auxier, Westinghouse Electric and Manufacturing Company.

TENNESSEE EASTMAN CORP. HAS ISSUED A NEW SCHEDULE of prices on Eastman cellulose acetate, both flake and granular, and cellulose triacetate flake.

S. W. H. (SAM) JONES, FOR NINE YEARS WITH PLASKON CO., Inc., has been appointed General Sales Manager of the Plastics Division of the Gorham Co. Mr. Jones is located at the New York office of the company, 6 W. 48 Street.

AMERICAN MOLDING CO. HAS TAKEN OVER THE PLANT AND equipment of the Universal Molding Co. and will operate from the Universal plant at 16th & Vermont Sts., San Francisco. W. D. Love, president, states that pending contracts will be filled by American Molding Co. under present terms. E. Marx will continue as manager of sales of the combined companies.

QUICK POINT PENCIL CO., ST. LOUIS, MO., SPECIALIZING in color printing on plastic articles, states that it is now fully prepared to injection mold plastics, make plastic dies and completely fabricate pyroxylins, in its new molding division, the St. Louis Plastic Moulding Co., and that a new plant is being built.

THE REX CO., 716 COLUMBUS AVE., BOSTON, MANUFACturers of translucent plastic Venetian blinds, has declared a substantial reduction in price of these products brought about through increased production facilities and a new marketing plan of selling direct from the factory to the retail dealer and decorator. A new price list and specification sheet is available to those interested.

R. H. CHEMICALS DIVISION OF E. I. DU PONT DE NEMOURS & Co., Inc., has issued a new quarterly price list, available to the trade.

A NEW COLD MOLDING MATERIAL, CALLED ROCKITE, HAS been developed in England by Cellomold, Ltd., which, according to reports, is based upon phenol-formaldehyde and in its natural state has the appearance of stoneware, although some colors are available. It is said that the material can be molded in a cold positive mold under a pressure of 1 to 1¼ tons per sq. in., after which the articles should be

WHAT ARE "PLASTICS"?

plas'tic, 1 plas'tik; 2 plas'tic, *a.* **1.** Giving form or fashion to matter. **2.** Capable of being molded. **3.** Pertaining to modeling or molding; sculptural.

—Funk & Wagnalls Standard Dictionary

Where can I get full, timely information—on these materials that "give form and fashion to matter"?

MODERN PLASTICS will bring literally dozens of fresh ideas to improve *your* product with new beauty, new distinctiveness, and powerful sales appeal.

If you are not now receiving it regularly, just mail the subscription card that is bound in this copy. We guarantee you a year full of the most interesting, profitable reading. And you will receive, without extra charge, the big October CATALOG-DIRECTORY issue—the annual "Encyclopaedia of Plastics Products." So send in the card today.

MODERN PLASTICS
CHANIN BUILDING 122 East 42nd St., New York, N. Y.

baked for a period, according to thickness of sections, of 1½ to 2 hrs. at a temperature of 120 deg. C.

In certain instances the material can be carved and manipulated by hand in its soft state, then subjected to the baking time mentioned, it is claimed. F. A. Hughes & Co., Ltd., Abbey House, Baker St., London, N. W. 1, are sole distributors.

THE ROYAL SOCIETY OF ARTS OF GREAT BRITAIN HAS CONferred upon Raymond Loewy, noted American Industrial Designer, the distinguished and unprecedented honor of "Royal Designer to Industry." This Society for "The Encouragement of Arts, Manufacture and Commerce" was founded in 1754 and has as its patron the British King. For the first time in its history the Royal Society has departed from precedent and dignified a non-British subject.

APPOINTMENT OF THE URQUHART SERVICE CO., 1501 WYNkoop Street, Denver, Colorado, and 417 Dooley Block, Salt Lake City, Utah, as sales representatives has been made by the Ajax Flexible Coupling Co., Westfield, N. Y., and in Chicago, Ill., Chicago Pulley & Shafting Co., 17–23 N. Desplaines St., has been appointed distributor of its flexible couplings.

RHOPLEX W-66, AN IMPORTANT ADDITION TO ITS LINE OF solvent free, water-dispersed, colorless, synthetic resins, developed for the production of permanent finishes on textiles, paper and other water absorbent materials, is announced by Röhm and Haas Co., 222 W. Washington Sq., Philadelphia. The clear resin, deposited from this aqueous dispersion in a continuous thermoplastic film, contains no organic solvents or plasticizers, and may be used in acid, neutral or alkaline solutions. Unusually tough and flexible, it is reported to increase the strength of textile fibers and fabrics and to be an effective agent to bind and set soft twisted yarns and fibers, increasing depth and brilliance of color as well as fullness and body of materials.

Standard textile equipment may be used to apply these resins, and no curing, heating or special fixing process is necessary. The finish on the cloth may be varied to a wide range of hardness or softness. When used as a finish, the thickness of these resin films on the goods is the merest fraction of an inch. The photograph above shows fabric seen through two thick sheets of the clear film, approximately a half-inch thick, without distortion of color pattern.

JEAN DELORME, CHEMIST, AUTHOR AND INVENTOR, OF Pont-du-Lizon, France, has reported the development of a "dispositif" which permits the manufacture of casein rods "with a perfectly controlled design of multiple colors for the production of completely mottled casein buttons." Patent rights have been issued in Canada, we are told, and several claims have been allowed in the pending U. S. patent applications, which have been assigned to the George Morrell Corp., Muskegon Heights, Michigan, according to the report.

FELIX GILBERT, INDUSTRIAL DESIGNER, 710 NINTH AVE., New York, advises his availability for service in product styling in the plastics field. Telephone number is Plaza 5-8861.

UNIVERSAL PLASTICS CORP., NEW BRUNSWICK, N. J., ANnounces the resignation of Stanley R. Levy from its sales department.

WILSON & GEORGE MEYER & CO., DISTRIBUTORS OF AGRIcultural and industrial chemicals, and Pacific Coast representative of Tennessee Eastman Corp., has recently opened its new Seattle, Wash., office at 1020 4th Ave., South, with F. M. Pape as manager.

A 1939 MACHINE TOOL SHOW, TO BE HELD IN CLEVELAND, October 4–13, has been scheduled by National Machine Tool Builders Assoc. 10525 Carnegie Ave., Cleveland. Exhibits will include machine tools, displays of makers of machine tool accessories, and allied equipment. A Machine Tool Congress, sponsored by the professional engineering societies, will be held in evening sessions.

AMERICAN ENGINEERING CO., PHILADELPHIA, MANUFACturer of Lo-Hed Monorail electric hoists, announces the appointment of A. C. Cooper Sales Co., 220 E. 42nd St., New York, specializing in selling materials, handling equipment, as sales representatives for metropolitan New York, Long Island, and Northern New Jersey. Also it has recently purchased the Diamond Machine Co., Providence, R. I., and will continue the manufacture of the Diamond Face Grinder in its Philadelphia plants.

SPEED NUT DIVISION OF TINNERMAN STOVE & RANGE CO. advises us of having completed negotiations for the manufacture and sale of patented speed nuts in England and on the Continent. Contract covering the manufacturing and sales rights was negotiated and completed with the Simmonds Aerocessories, Ltd., Shell-Max House, Strand, London W.C.2, England.

PROMOTION OF F. A. ABBIATI TO ASSISTANT GENERAL MANager of sales of Monsanto Chemical Co.'s Plastics Division was confirmed recently by John H. Clark, general manager of sales. Mr. Abbiati, who for twelve years has been active in both development and sales work at the Merrimac Division will have headquarters in Springfield.

P. A. MONGER, FOR TWELVE YEARS CONNECTED WITH Western Newspaper Union as a branch manager in Philadelphia and Cleveland has been appointed to the sales staff of Lake Erie Engineering Corp. of Buffalo, N. Y. Mr. Monger has had a wide experience in newspaper and syndicate production as well as commercial stereotyping and rubber plate making. He will be principally concerned with the sale of Lake Erie Acraplate Vulcanizers for rubber plate making, and the Directomat Matrix Moulding Press, marketed by the Lake Erie Stereotype Equipment Division of the corporation.

WILLIAM O'NEIL, industrial designer, has moved his offices to larger quarters at 50 Rockefeller Plaza, New York.

A NEW TYPE FLOOR COVERING DEVELOPED IN GERMANY promises to reduce the country's consumption of linseed oil, which heretofore has been imported in considerable quantities for the manufacture of linoleum floor coverings, according to reports from the American Consulate General at Frankfort-on-Main, made public by the Chemical Division, Department of Commerce. The new floor covering is a plastic product of acetylene origin which resembles linoleum not only in appearance but in its heat and sound insulation properties and can be processed with the same equipment used for the manufacture of linoleum, the report said.

Tons upon tons of DICALITE rock are here shown immediately after quarrying and just before going to the DICALITE plant for processing into DICALITE Products of uniform superior performance at *lower* cost per unit of your finished product.

Why DICALITE Fillers are *Best* for PLASTICS

--- cast, molded and laminated

MOST products used for fillers have a loose weight of 60 to 80 lbs. per cu. ft. COMPARE this with the weight of DICALITE Fillers which in loose form are from 7 to 16 lbs. per cu. ft. This means you get greater bulking (more volume) from each pound of DICALITE—in other words, *lower* cost per unit of finished product.

And your finished PLASTICS—cast, molded or laminated—will have increased strength, better color qualities, greater durability, and improved heat and fire resistance.

Why not investigate today?

Use DICALITE FILTERAIDS in the clarification of resins, varnish, oils, solvents, etc.

THE DICALITE COMPANY

520 N. Michigan Ave. CHICAGO · 120 Wall St. NEW YORK · 756 S. Broadway LOS ANGELES

PRODUCTS OF UNIFORM SUPERIOR PERFORMANCE

Costume Jewelry fabricated in GEMSTONE. Courtesy Milton E. Brown & Co., 381 Fifth Ave., New York

So brilliant and lustrous is GEMSTONE—and with such sparkling depth and richness of color—that it actually replaces precious stones. The samples of costume jewelry, shown here, are remarkably inexpensive, yet the photographs cannot do justice to their striking beauty.

GEMSTONE is a new material—unsurpassed in eye appeal—easily cast in a multitude of shapes and forms—or available in standard sheets, rods and tubes. Write for samples.

A. KNOEDLER COMPANY

LANCASTER PENNSYLVANIA

TOYS FOR SALE

(*Continued from page 25*) them as gifts. Likewise, toys which develop sharp edges when broken are shunned after the first personal experience with scratches and cuts.

Heavy toys for small children with which they are likely to injure themselves are also ill advised.

There are reasons why toy manufacturers are using more plastics in production than ever before. Plastics have been used constantly ever since celluloid was discovered but the inflammable nature of this particular material has caused it to be largely replaced by cellulose acetate which is a slow burning material—no more inflammable than wood.

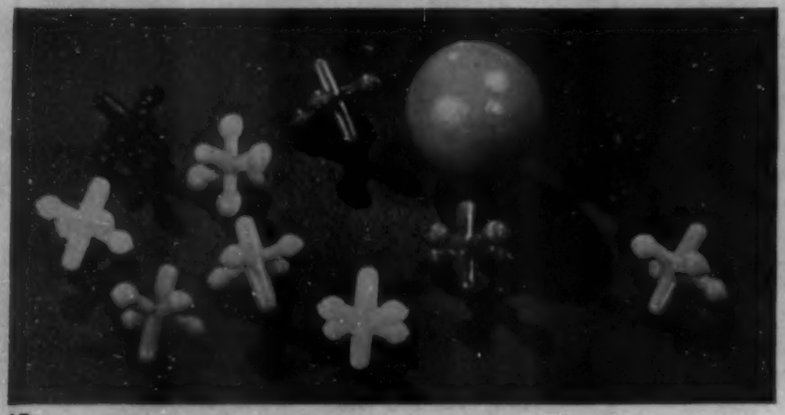
When injection molding came along to make rapid production of small toys possible, cellulose acetate was able to compete in cost with the less expensive materials.

Soldiers, automobiles, airplanes, musical instruments, dolls, jackstones, banks, dolls' dishes, furniture, and innumerable other toys and games are being turned out of these colorful materials which are harmless to play with and, when made with the proper wall thicknesses, are lasting and safe. Their color goes all the way through and cannot come off even though toys are placed in the mouth of an innocent child. Teething rings are made of plastics of various kinds. Hoover Products, Inc., recently introduced *Plakies* in attractive pastel colors using urea material. *Plakies* consist of a series of colored molded disks strung on a bead chain for teething.

"Our reason for using plastics," says Mr. Hoover, "is largely one of durability. One of our policies is to make only toys that possess sufficient strength and weight to stand up under extraordinary use. Many times we could decrease the weight of the material in the interest of

15

16



17

18

15. In the game of Poker-Golf, players tee off against each other by throwing Plaskon dice, imprinted with playing card symbols, from a cork-lined Plaskon cup. Dice and cup are molded for Adult Games, Inc., by Imperial Molded Products Corp. 16. The Tenite Hi-Yo Silver Lasso Spinner is molded and manufactured by Kilgore Mfg. Co. 17. Susie Q and Swing Time plastic jackstones, larger than old-fashioned cast iron ones, have no sharp edges that might cut fingers. They are rust-proof and will not chip or break under ordinary use. Ohio Plastic Co. molds them of Bakelite cellulose acetate and Tenite in a variety of colors. 18. A new version of the old numbers puzzle game comes from Ritzma-Werk Co. It is molded of Bakelite and the numbered squares are grooved to slide around easily and conveniently in the frame

NATIONAL

RESIN COLORS

BRILLIANT
UNIFORM

•

A COMPLETE LINE OF COLORS
SPECIALLY MANUFACTURED
FOR BOTH MOULDED AND
CAST PLASTIC COMPOUNDS

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WE INVITE YOUR PROBLEMS

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NATIONAL ANILINE &
CHEMICAL COMPANY, INC.
40 RECTOR STREET NEW YORK, N. Y.

BOSTON • SAN FRANCISCO • ATLANTA
PROVIDENCE • CHARLOTTE • CHATTANOOGA
CHICAGO • GREENSBORO • PORTLAND, ORE.
PHILADELPHIA TORONTO

Branches and Distributors throughout the World

RESIN DYES

GENERAL PHILIPPE HENRI PÉTAIN WAS PAINSTAKINGLY CAREFUL

This general of the World War has been called the greatest tactician of the Allied Armies. His plans were thought out to the minutest detail, and in attack or defense his preparations were well-nigh perfect. The foundations for the final Allied victory were laid in advance by Petain.

Your Molded Plastic Parts will be carefully made by

GENERAL INDUSTRIES

• When you place an order with General Industries for molded plastic parts you can fully rely on the many details being carefully supervised at every step. All specifications will be accurately fulfilled, appearance and finish everything you desire.

You realize economy, too, when you make General Industries a source of supply. Modern equipment and high efficiency work to your benefit in terms of lower costs as well as high quality.

At General Industries we are prepared to handle any job from start to finish, including the producing of metal inserts in our machine department.

REMEMBER—*"General Industries"—when the next job comes up for consideration.*

GENERAL INDUSTRIES CO.
Molded Plastics Division
OLIVE AND TAYLOR STREETS • ELYRIA, OHIO

19

20

21

economy but we prefer to recognize the element of safety in children's toys as being of paramount importance."

We quote Mr. Hoover because we have found that his attitude toward the safety and welfare of the children for whom his toys are made, is typical of the approach toward modernizing toys with modern materials being made by many manufacturers now using plastics in one form or another.

We don't wish to give the impression that plastics are better than all other materials for toy and game manufacture. They are not. But we do want to point out that many different kinds of plastics are available which have certain inherent advantages not found in other materials and that manufacturers of toys and games not now using them might profit through a better understanding of how others are using them intelligently and with a successful merchandising profit.

In a recent survey, we found several contradictory statements by manufacturers who are using plastics and those who are not. The most controversial question, naturally, was cost.

As a balance to those 30 percent who said costs were too high, there are 31½ percent who said costs were no greater than with former materials used. Twenty-six percent of the manufacturers we contacted use plastics and find them practical to their lines. Thirty-four percent have considered them or are using them experimentally. (This figure includes the 30 percent who find their cost too high.) Only 14 percent have not considered them at all.

Some manufacturers do not find plastics in any of their present forms suitable to the things they make. Others find the colorful materials have far greater selling possibilities than the materials they had been using and are quite frank about saying so.

They point out that plastics are lighter than wood and metal in the necessary thicknesses to make these materials practical for toys. They have found, by actual experience, that money can be saved through the use of plastics because these materials do not have to be painted or lacquered, that they are lighter in weight for shipping, less fragile on dealers' shelves and in demonstration because they do not dent or scratch, have a better appearance and meet a specific demand by a modern public.

Among all the manufacturers to whom we wrote, we found but two who had brought out a plastic toy that met with a poor reception. *(Please turn to next page)*

19. The Lionel Corp. uses molded plastics for trains and railway accessories because they can be designed to obtain durability, realism and action. 20. A rattle-proof, trouble-proof accessory for night cycling is Delta Electric Co.'s Guardlite bicycle tail light. Designed by Barnes & Reinecke, it is molded of Tenite by Chicago Molded Products Corp. 21. Pull the trigger of this sinister looking weapon and it discharges no whizzing bullet—only a beam of light that's handy for finding the keyhole in the dark This Microlite flashlight has a plastic molded housing

Selected dyestuffs and organic pigments for the coloring of plastics

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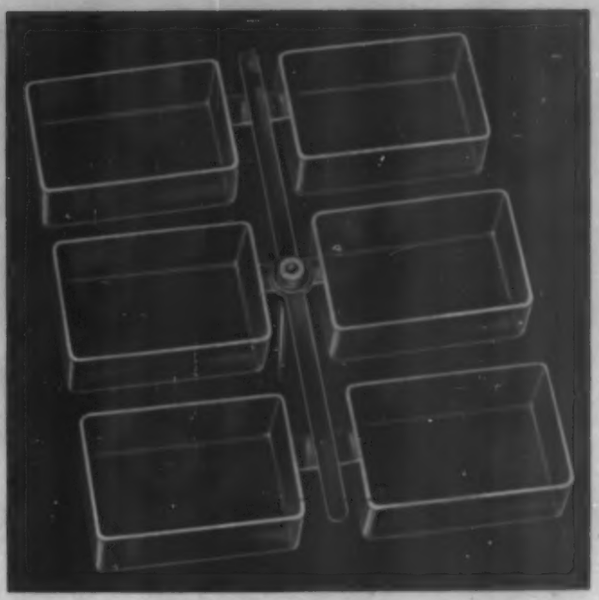

Molded by—
Belmont Molded Plastics, Inc.

And ... they molded it on the GROTELITE Injection Press!

COLORLESS transparent boxes, each measuring 3¼ inches long, 2¼ inches wide and 1¼ inches deep. Weight of the six molded parts, as shown, 5¾ ounces; projected area, 33 square inches; thickness of section, .060 inches. Clarity, and perfect surfaces were essentials. Fast and uniform piston speed embodied in Grotelite Triple Pump System produced this beautiful piece with ease and economy.

Pioneer builders of Injection Machines in this country, Grotelite has concentrated its efforts on eliminating difficulties and waste in injection molding.

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Write for details

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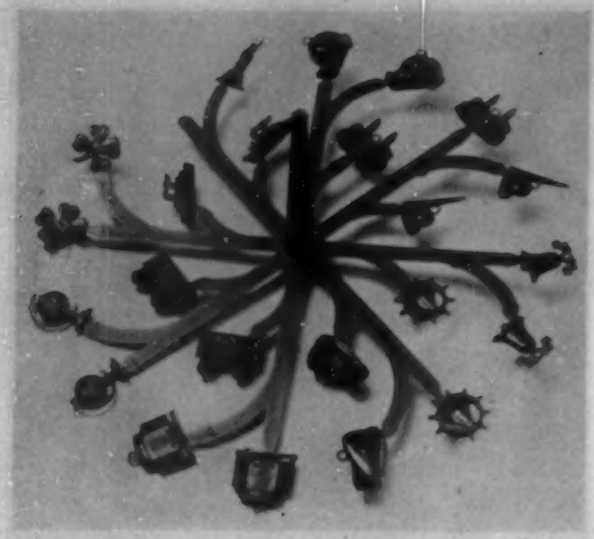

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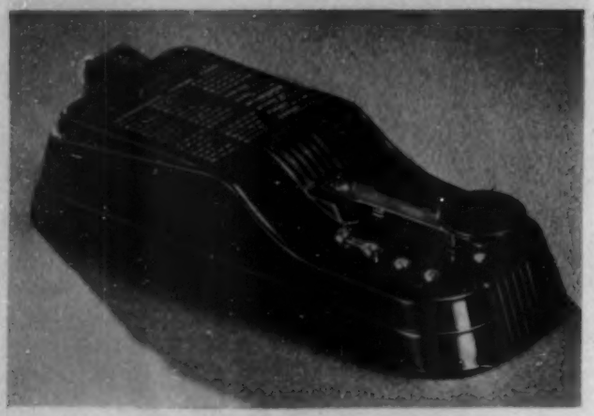

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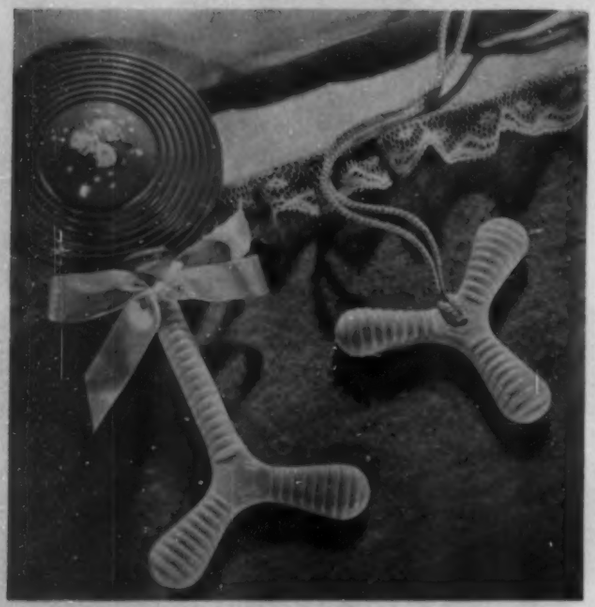

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22. A sprue, just as it comes from the injection press at Plastics, Inc., shows how small parts are made. 23. A device incorporating a radio buzzer, blinker and telegraph, developed by M. M. Fleron & Sons, Inc., is suggested for Boy Scout signal practice. Molded of brown Bakelite by Gorham Co. 24. Scientific teethers, designed by Carl E. Allen, D.D.S., are injection molded of Tenite for Baby's Pal Co. by Gits Molding Corporation

Our answer to those who have found the price too high must naturally point to other products such as buttons, bottle closures, jewelry and premiums which have been turned out by the million within a price range that found ready markets. The continuance of production of such items can indicate but one thing—that they are satisfactory in use. Add to that the fact that many manufacturers of toys and games are successfully using plastics, which are illustrated on these pages, and we can only wonder if those manufacturers who find the cost too high have made the proper approach to this problem.

We wonder if they have exhausted the more likely sources of supply which are indicated on these pages through illustration. We recognize that mold costs, if taken as an item apart, seem high in comparison to die casting and some other methods of production. But when figured per unit over a period of one or more years, they usually amortize themselves through savings in finishing costs and reduced shipping weight so that in the end they are no factor at all. Furthermore, if the appearance of the product is improved and gives more lasting satisfaction in use—it is more than likely to affect sales to advantage.

Those who have investigated plastics in the past and found them deficient in one way or another may find that the ever-changing technique in plastic fabrication has worked around to a point where their objections have been overcome. We refer particularly to automatic molding by both injection and compression methods.[1]

The Lionel Electric Corp., well-known manufacturers of electric trains, operate their own molding department which includes ten or more presses, five of which are completely automatic.[2]

A. C. Gilbert Co., another manufacturer of toy electric trains and electrical household goods is installing modern automatic molding equipment.

There are literally hundreds of custom molders equipped to turn out modern toys and games and if the right approach is made to them, they are in a position to engineer molds and plan production schedules that will fit almost any manufacturing problem.

Toys, generally speaking, are mass production items and the fabrication of plastics is becoming more and more a mass production process. If this were not so, the automotive industry could not make such general use of these materials. Neither would they be found in such quantities in so many varied items in retail stores.

Games, perhaps, offer even greater opportunities for plastics in service. Poker chips, precision dice, chessmen, checkers, and many other items of play have been made of plastics almost since celluloid was discovered. Cast resins replaced this material in some of the items during recent years. Both had to be turned by hand or machined and finished. Some molding of celluloid is done but not much. Some cast resin is formed in rubber molds but most of the items that reach the market in quantity have been more or less hand made.

(Please turn to next page)

1. Modern Plastics, July 1939, The Changing Pace, page 29.
2. Modern Plastics, Dec. 1938, Playthings, page 42.

UNIVERSAL PLASTICS CORPORATION

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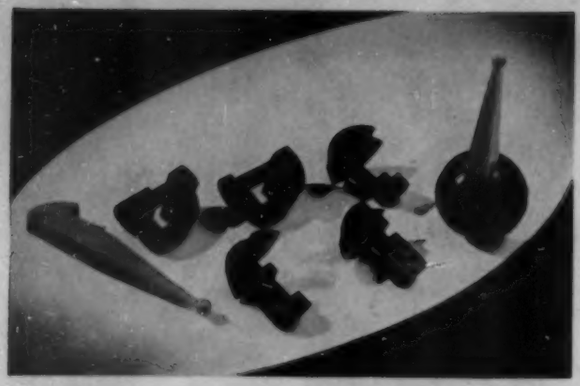

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Six intricate molded plastic parts, assembled to fit perfectly, solve the Perisphere and Trylon interlocking puzzle (Fig. 25). It is injection molded of acetate for Helen Hart Novelty Co. Safe, since it does not shoot caps, the "Gene Autry" play gun (Fig. 26), with bright red handle grip molded of translucent Bakelite acetate by Plastics, Inc., has all the likeness of a real six shooter

Injection molding and automatic compression molding will change this situation before long so that when long runs of considerable quantity are required, it will be economical to build molds. Games involving toy soldiers, policemen, Indians and such are being molded successfully from cellulose acetate materials now.

Another good example to illustrate this trend toward economical molding of game characters and similar objects is given to us by the Universal Game Co., makers of *Helios, the Game of the Gods*. It offers a good example, too, of how the soft lustrous finish of plastics helped to introduce this new game and make it desirable to own.

The production of the characters required (Fig. 8) presented an entirely new problem in the game field, according to George J. Perl, who gave us the information. The game incorporated astronomy, astrology and Greek mythology and had an appeal to sophisticated game lovers. It is a scientific game which, upon asking the opinions of a number of prominent professors of Astronomy, was found more fascinating than chess and had a greater appeal. Everything associated with it pointed to the unusual in the game field and required materials entirely in keeping with the sciences and literature connected with the game.

"Special care was taken in designing and printing the playing board and rule book," writes Mr. Perl. "When we came to the manufacture of the playing pieces, we had a real problem to work out. First, we had them hand-tooled in wood and found there was something lacking. We also found we could not get the proper design of symbols of astronomy and astrology and still have the pieces machine tooled. Metals were then considered and upon checking with a number of buyers and individuals, we found that where metal appealed to men, the women in the group said they did not like the cold feel of the metal playing pieces. One was quite outspoken and said she did not like to feel metal and hoped we would find some material more in keeping with the Gods of Helios.

"We decided to try plastics and our next difficulty was to find a tool and die manufacturer who could make the dies so that we could use actual astronomical symbols for our playing pieces. We found that injection molding of cellulose acetate answered our needs satisfactorily.

"Since making this decision we have had many compliments on the appearance of the Helios playing pieces and the plastic definitely is helping sell this game more quickly than any other product we could have used. If we had used metal, the shipping cost would have been increased and breakage would have been a problem with metal as well as wood.

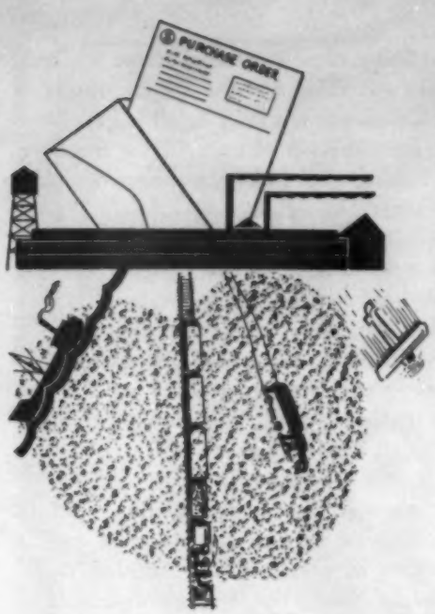
"We are certainly satisfied with plastics and our customers are not going to have paint or enamel chip off their playing pieces. Stores will not have shopworn merchandise because no matter how often the Helios playing pieces are used or demonstrated, they always look the same."

Surely, there is nothing we could add to this convincing experience of the Universal Game Co. which could recommend plastics more highly to others in search of a share of this profitable market.

We do suggest, however, that those who have tried plastics in the past and found them wanting—should approach every angle of their possibilities and weigh their many advantages before passing them by. Remembering that each new toy presents its own difficulties of manufacture, no matter what material is used. It is well to remember, too, that price alone is seldom the reason why people buy.

Merchandising of toys and games has had a real overhauling in the last decade. Plans recently outlined by the Toy Manufacturers of the U. S. A. clearly indicate the path of progress and expansion which manufacturers and retailers are urged to follow in order to realize the success this field offers to those who take advantage of every opportunity open to them.

Successful merchandising, however, depends upon something more than a good plan. The merchandise itself must be right. It must be a good value for the price asked whatever that price may be. The right choice of materials frequently determines this factor in modern toys and games.



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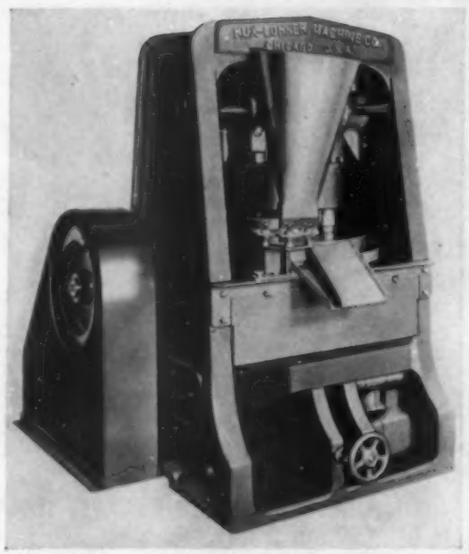
MOLDERS OF ALL PLASTICS—Including Hard Rubber—SINCE 1897



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Surface – Needle – Mold

PYROMETERS

Bulletin 194–S gives details of these instruments. They help save money and make better plastics.

DESIGN TAKES A HOLIDAY

(*Continued from page 39*) General Motors Building. Here, Mr. Geddes explained, the signs are suspended from the edge of a cantilevered ceiling, and are exposed to the weather. The letters, 5 ft. in height, have been sand blasted on the sides and polished on the edges. Fluorescent tubing is again placed in back of the individual letters, and the entire device is suspended by a copper U-shaped bar. The result is an effective glow emanating from the 8-in. deep sides of the large plastic letters. In addition, the image of the tube is projected to the front edge of the glass-like material, probably the largest installation ever made; brilliant is the word to describe the effect of the 230 ft. sign that is utilized to carry the names of all the General Motors autos. Plexiglas is also used in the models taking the shapes of buildings within the General Motors Building.

The five great Focal Shows of the World's Fair present plastics in a number of ways. In the Production and Distribution Focal Show there is a metal statue by Otto Wester which poses our chief problem for the future—how to make our abundance available to all. On either side of this statue are tall tubes of light, rising from the floor to a height of 20 ft., shaped like giant thermometers. These tubes are of plastic material.

Again, in the Communications Focal, the center of interest is a huge head of Man by the designer Donald Deskey. Suspended in mid-air, 20 ft. in height, this head is modeled of stainless steel and plastics. As Man speaks, the symbols of the seven major instruments of communication—postal service, printed word, telegraph, telephone, motion picture, radio and television—materialize on a plastic disk in front of him.

In the Science and Education—Medicine and Public Health Building, George Sakier has mounted photographic transparencies—a strip of them almost 200 ft. long—between sheets of plastic film. Another noted industrial designer, Egmont Arens, has made use of Lamicoid, a laminated plastic material, to represent the

31

Tennessee Eastman Corp. exhibits Tenite products (Fig. 31) in the Eastman Kodak Building where the variety of uses of cellulose acetate molding compounds are graphically presented

32

In the Du Pont "Wonder World of Chemistry" exhibit several plastic forming operations may be seen. Two operators at the left (Fig. 32) are bristling and trimming Pyralin tooth brush handles with the new Exton bristles. At the right, a Reed-Prentice injection press turns out combs of Plastacele. The exhibit is surrounded by a Lucite rail

DON'T MOLD

—until you check costs with this economical method!

If it's round and small, make it on an automatic screw machine from Ameroid Rods—and save expensive mold charges. Ameroid is easily turned, threaded, drilled and polished. Non-inflammable.

Ameroid Casein Plastic Round Rods are available from stock in a large range of plain colors, also Black and White. Ground to desired diameter from ¼" to ¾", inclusive, and as small as $\frac{1}{16}$" to order.

If you are not equipped to turn the parts, experienced fabricators will do it economically. Write for samples of radio parts, knobs, bushings, fishing reel handles, etc., made on screw machines with Ameroid Round Rods.

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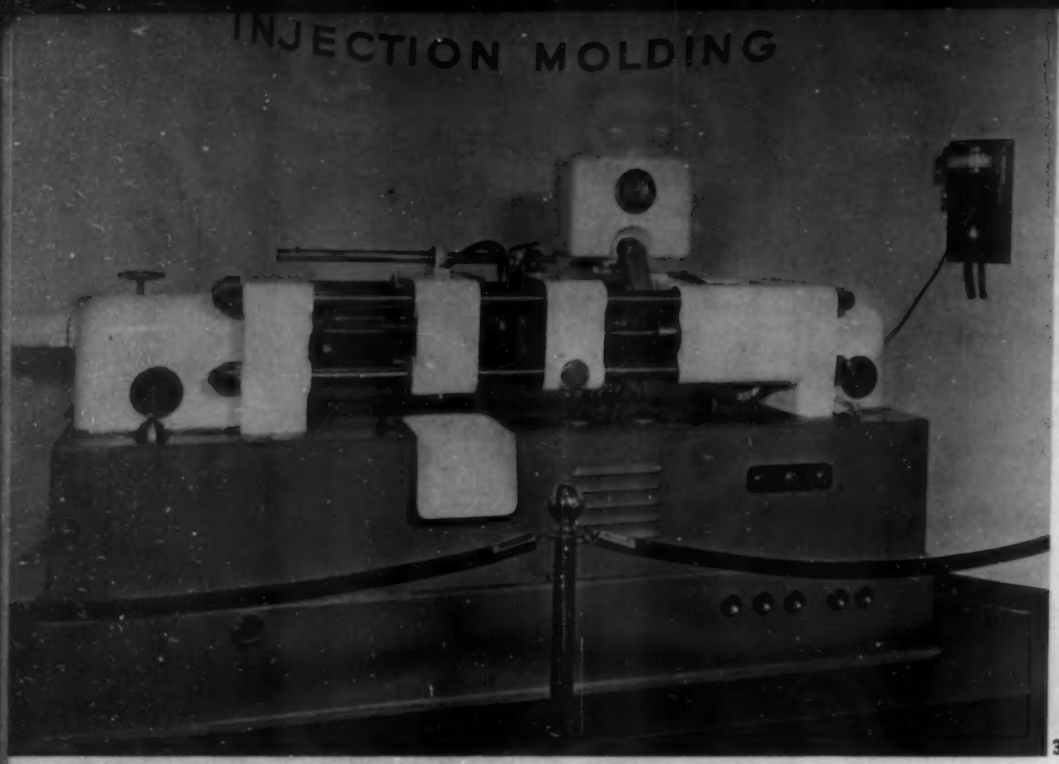

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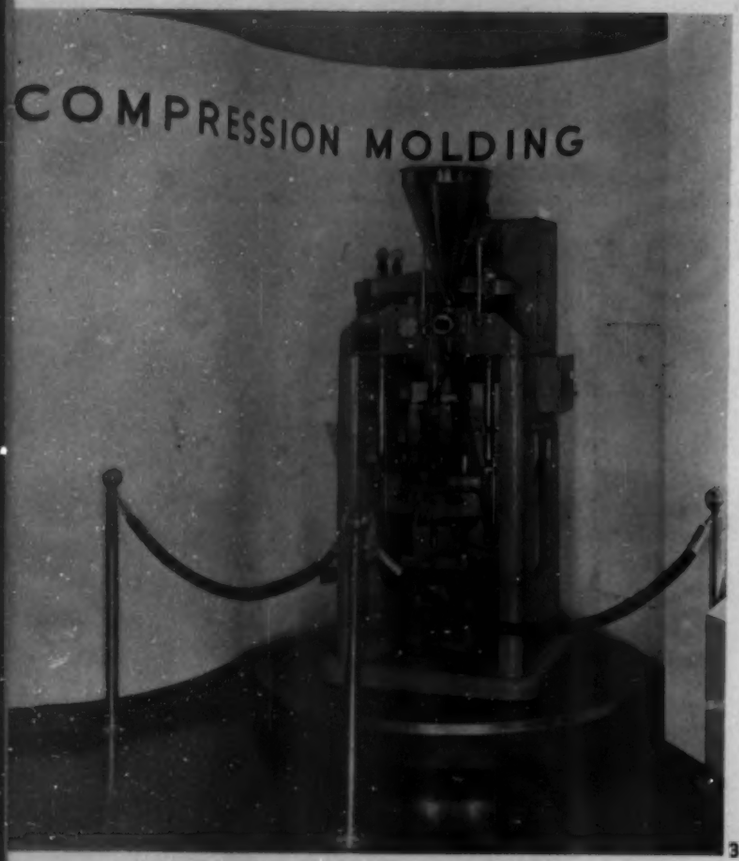

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Four lapel souvenirs are molded from acetate at the rate of 900 per hour on this H-P-M injection press (Fig. 33) operating in the Hall of Industrial Science. Additional lapel souvenirs are molded from phenolics and ureas at the rate of 250 per hour on an F. J. Stokes automatic compression press (Fig. 34). Both presses are operated in the exhibit of the Bakelite Corporation

earth and clouds in an exhibit in the Production and Distribution Focal mentioned.

Still another, Gilbert Rohde, stresses the use of plastics in display technique. The show-window with three-dimensional curves may soon be a common sight on our fashion avenues. It was considered fairly startling when a year or two ago, advanced merchants introduced the show-window with an S-curve, designed to minimize glare. We may shortly see windows with a variety of curves, for decorative as well as practical installations, if Mr. Rohde is a good prophet.

Minor uses of plastics at the Fair tend more toward the adaptations with which the public has already grown familiar. Forty-seven flashing symbols of Lucite locate Consolidated Edison properties on a map of the area served by that company, for example. Explanatory text accompanying the National Cash Register Co.'s exhibit is of edge-lighted Lucite. The official uniform of many of the World's Fair attendants—a coat of tan gabardine with blue trousers with an orange stripe—has buttons of Plaskon, embossed with the Trylon and Perisphere. Members of the Information Squad, before they were dismissed and waded through the Lagoon, carried swagger sticks of clear transparent Lucite with blue handles and ferrules. Front and rear windows of the Greyhound buses that operate within the Fair grounds are of Plexiglas, and when it rains, Monsanto Vue-Pak is rolled down over side openings to protect passengers.

Plastics for the Exhibit Builder

Plastics mean more, perhaps, to the exhibit builder and display man than they do to the artist, architect or designer; since it is the exhibit builder, more often than not, who deals with actual problems of construction.

In this respect the comment of E. H. Burdick, president of the Diorama Corp. of America, is interesting. "In the design and construction of modern exhibit units,"

Reduce Molding Costs

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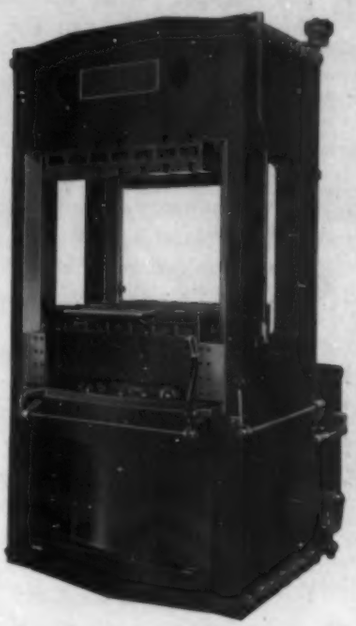
PRESSES



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Send for samples—and note the improvement over present materials. Prices available upon request.

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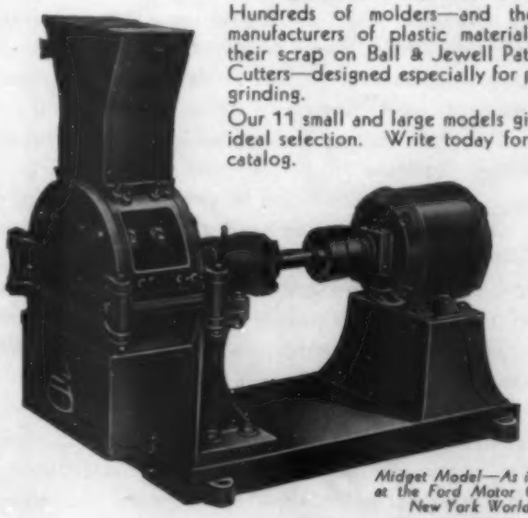
Hundreds of molders—and the leading manufacturers of plastic materials—reclaim their scrap on Ball & Jewell Patent Rotary Cutters—designed especially for plastics regrinding.

Our 11 small and large models give you an ideal selection. Write today for our new catalog.



Midget Model—As in operation at the Ford Motor Co. Exhibit, New York World's Fair.

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It's in the small details where a molding like this shines . . . Inserts and holes are molded in to eliminate tapping and drilling to speed up assembly, to reduce costs. Whether your job is "run-of-the-mill" or a more intricate piece, K & J is equipped to carry it through from molding design, mold making to finished molding.

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he says, "the use of plastics becomes increasingly important with each passing month. As exemplified by exhibits built for the 1939 New York World's Fair these uses are extremely varied, interesting and appealing. Especially important to the display field has been the discovery of a plastic having varying degrees of transparency, that can be cast under its own pressure without excessive heat and in an ordinary plaster of Paris mold.

"Display units of the future, with their light and mechanical movement, will undoubtedly utilize plastics in a constantly increasing amount and in applications yet undiscovered in this new but important industry."

The Diorama Corp. is responsible for a number of plastic pieces at the Fair: a "Niagara Falls" presentation and a relief map of New York State for the New York State Building, a relief map of North and South America for the Pan-American Union Building, and a three-dimensional mural for the Coca-Cola Co. The Niagara Falls diorama is 30 feet in length; a major undertaking. The Coca-Cola mural, designed by Skidmore and Owings, is 140 feet long and embodies cast plastic Coca-Cola bottles, $^5/_8$ full size.

The Plastics Industry at the Fair

The Plastics Industry itself has exhibits at the Fair. Some firms show their products in their own buildings—Du Pont and General Electric, for example. Other firms appear in the Hall of Industrial Science.

The General Electric Co.'s exhibit, where it is devoted to the company's plastics division, utilizes plastic materials for display and decoration. The face of the displays are covered with laminated Textolite-Parkwood and Textolite and the cases and shelves are lined with the same material in ivory. A decorative sphere overhead, lighted internally, has a rotating band of opaque plastic material lettered to identify the exhibit.

Three presses, each with a two-cavity mold, are in operation continually to mold small letter-openers in the form of the official World's Fair theme symbols for distribution to visitors. Also on exhibit are a number of the plastics products manufactured by General Electric: paper cutters, coffee-grinding machines, stenotype machines, dry shavers, thermometer kits, shoe heels, adding machines, flashlight cases and soap dispensers.

Plexiglas and Crystalite, polymerized acrylic acid derivatives manufactured by the Röhm and Haas Co., may be seen in the Hall of Industrial Science in an exhibit designed by Gilbert Rohde. Plexiglas is the sheet and rod plastic. Crystalite is the molding compound. Plexiglas may be employed as a substitute for glass where shaping is required, and this application is demonstrated at the Fair by a spray-hood for a speedboat and an enclosure for airplane cockpits. Animated mechanisms demonstrate other properties of the Röhm and Haas materials, while showcases display a number of examples of their uses.

In order to focus attention on Plexiglas as a decorative material, this exhibit also displays a sculpture work chosen in a competition sponsored jointly by Röhm and Haas and the Museum of Modern Art of New York City.

A new type of plastic for use in safety glass in motor vehicles, Butacite (vinyl acetal resin), is on display in the Du Pont Building. A sheet of Butacite is sandwiched between two layers of glass and physically sealed by heat and pressure. When the glass is broken upon impact, the fragments stick to the plastic instead of flying. Lucite's faculty of carrying light around curves, as a pipe carries water, is demonstrated in the Du Pont exhibit; an 8 lb. "diamond" of the material rotates in a blaze of light, and revolving color wheels throw tinted light through Lucite blocks.

Du Pont's man-made Exton bristles, which may eventually replace hog bristles, are shown, and a Reed-Prentice injection molding machine turns out pocket combs while visitors watch. Exhibits of other molded articles and of sheets, rods and tubes of Pyralin cellulose nitrate and Plastacele also are on display.

The Tennessee Eastman Corp. displays its Tenite in the Eastman Kodak Building. The B. F. Goodrich Co. exhibits its synthetic elastic, vinyl chloride (Koroseal), in its own building at the Fair, and demonstrates some of the processes of its manufacture. Some of the plastic products produced by the plastics division of the Firestone Tire & Rubber Co. are displayed among other Firestone products in its exhibit building.

The Bakelite Corp. exhibits in the Hall of Industrial Science Building. Its display shows visitors that without plastics, today's automobiles, machinery, aircraft and railroads would not function with the dependency and efficiency we have learned to expect of them. Here the public becomes aware that people nowadays eat, drink, groom and clothe themselves, decorate their homes, cook their meals, write letters, play games, drive their cars, listen to their radios and do a thousand and one other things with the help of plastics.

Automobile parts making use of plastic materials are on display, as well as the interior of a pilot's cabin from a transport plane. Small "peep show" cabinets built into the walls show everything from radio parts made of plastics to plastic materials for bridge games, cribbage boards, poker chips, musical instruments and surgical and dental appliances. These latter include a plastic skull section, used in surgery, plastic dentures and a plastic Braille board with changeable type for the instruction of the blind.

A Stokes automatic molding press turns out souvenirs at one end of the Bakelite exhibit, while an H–P–M injection press operates in the other wing. These presses attract considerable attention since they afford many visitors their first opportunity to see how plastics are pressed from molding compounds into completed objects by a single stroke.

It would be impossible here to detail a complete record of all the places where plastics are used at the Fair. But in presenting this brief sketch with pertinent illustrations, it becomes apparent that these new and interesting chemical resins and cellulose derivatives have established themselves as important fundamental materials in structural and decorative adaptations as well as being practically indispensable to the progress of industry.

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INDEX OF REFRACTION OF TRANSPARENT ORGANIC PLASTICS

(*Continued from page 47*) placed in firm contact with the surface of the prism and with the polished edge toward the source of light. The index of refraction shall be determined in the same manner as for liquids. This shall be done by moving the index arm of the refractometer until the field seen through the eyepiece is one-half dark. The compensator (Amici prisms) drum shall then be adjusted to remove all color from the field. The index arm shall then be adjusted by means of the vernier until the dividing line between the light and dark portions of the field exactly coincides with the intersection of the cross hairs as seen in the eyepiece. The value of the index of refraction for the sodium D lines shall then be read directly from the instrument. The dispersion shall also be determined by reading the compensator drum and applying this figure, along with the index of refraction, to a chart or table supplied with the measuring instrument.

NOTE.—Sodium light from some type of a sodium burner is of use in increasing the accuracy and ease of setting of the refractometer.

Microscopic Method

Apparatus

6. The apparatus for the auxiliary method shall consist of a microscope having a magnifying power of at least 200 diameters. This microscope shall be equipped with a means of measuring the longitudinal travel of the lens tube to within 0.001 inch.

Specimen

7. The specimen described in Section 4 will be satisfactory for use with the microscopic method if it is not too thick to permit focusing the microscope through the polished surface (having a fair polish). A small specimen taken from a sheet of the material may be used if it is about 0.25 in. (6.3 mm.) in thickness.

Procedure

8. A specimen having two parallel surfaces shall be placed on the measuring microscope table with that surface having the best polish placed nearest to the objective. The microscope shall then be focused through the specimen and on the bottom surface. The reading of the longitudinal displacement of the lens tube shall be noted to the nearest 0.001 in. or less. Without moving the specimen, the microscope shall then be focused on the top surface of the specimen and the reading of the displacement again noted. The difference between these two readings is the apparent thickness of the specimen. The index of refraction is found by dividing the actual thickness of the specimen by the apparent thickness.

Report

9. The report shall include the following:

(*a*) The name of the method used.

(*b*) The index of refraction to the nearest significant figure warranted by the accuracy and duplicability of the measurement. If the index is specified to more than three significant figures, the wave length of light for which the measurement was made shall be specified.

NOTE.—In the case of nonisotropic materials the average index shall be reported.

(*c*) The temperature in degrees Centigrade at which the index was measured.

(*d*) If available, the dispersion shall be reported along with the index of refraction.

MODERN INDUSTRIAL TERMINOLOGY

(*Continued from page 44*)

Comparable, to a degree, with injection molding and applicable to thermosetting materials, is the transfer method of molding. This, briefly, is accomplished in a double mold with a plasticizing chamber in the top where the material is brought to a plastic stage, then forced through connecting gates into a chamber beneath which gives shape to the part being molded. The flow of material from the plasticizing chamber to the mold proper is gentle in character and, therefore, is not likely to upset or damage delicate inserts required to be accurately placed. Transfer molding requires no cooling of the molds and thermosetting materials are ejected hot.

In the thermosetting group of plastics recent developments have brought forth materials possessing much greater impact strength. It is, of course, a most progressive step when greater strength can be incorporated in molded parts without sacrificing surface appearance, but this characteristic can always be further improved upon by the use of proper design. The correct application of strengthening ribs or increased thicknesses at weak sections, for instance, will lend even more strength to a molded part. It must be remembered that very few plastics have a specific gravity exceeding 1.4 and hence reenforcements can be generously added without seriously affecting the weight. As a matter of fact, in practically every instance where plastics replace other materials the weight is substantially reduced, even though the volumetric ratio has been increased.

So far as the comparatively new transparent materials are concerned, their introduction opened up innumerable possibilities, that previously had not been considered. At first, it was thought that glass might be the only field encroached upon, but the discovery that transparents could be utilized in many other directions soon dispelled this idea, and they are consequently displacing other materials as well. Prior to last year the clear transparents were obtainable only in the thermoplastics, about a year ago it was announced that a transparent thermosetting material was available for commercial purposes. As a result, it is now possible to produce articles in deep transparent shades by conventional molding processes.

Light transmittant products, whether made from the thermoplastic or thermosetting materials, have numerous attributes which cannot be found in glass and the majority of these characteristics have been highly proclaimed by designing engineers. The reasons for this are many. In the first place, the clear plastics permit a much wider diversification of product design due to

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their ready response to such finishing operations as drilling and tapping. Secondly, inserts of various types can be molded into the transparent articles thereby placing them on a par with the translucents or opaques. Ordinary glass is brittle and tends to shatter under impact while the plastics, besides being much lighter in weight, are resilient and non-shatterable. It is just such characteristics as these that influenced aeronautical engineers to choose transparent plastics to replace glass in modern flying ships of today.

Mention of so many favorable qualities of transparent plastics should not be interpreted as being their only characteristics, for there are also numerous disadvantages generally recognized in the use of these materials. All thermoplastics are restricted to definite limitations with regard to heat due to the fact that they tend to soften or distort upon application of temperatures ranging from 140 deg. F. up to 180 deg. F. Consequently, acrylates or acetates fall into this classification. With the introduction of a new transparent thermosetting compound this limitation has been automatically removed, for such parts will withstand exposure to heat up to 225 deg. F. However, a crystal-clear product made from the latter type of material is not yet available, so for a glass substitute it is still necessary to specify the lower heat resistant thermoplastics. A general understanding of the methods employed to produce the different types of plastics, as well as a fair idea of the fundamental differences in the materials themselves, will go far toward gaining a general knowledge of the latest developments.

Casting of both thermoplastic and thermosetting materials is in a state of rapid development and its advantages and limitations should be understood by those in a position to specify materials for production runs. Both rubber and lead are being used for molds but the actual casting process still lies in the hands of materials manufacturers where polymerization (hardening and curing) can be carefully controlled.

Rubber molds, which must be made by those with experience in their structure, permit undercuts and other deviations from conventional molding not possible with any other technique. Splendid examples have recently come to light and have been illustrated in these pages.

Lead molds, economically formed on a master mandrel of steel, are used in increasing numbers for casting radio housings and other commercial parts. Either thermoplastic or thermosetting casting materials may be "poured" into such molds. The thermosetting materials must be cured or hardened under controlled heat. Both require a minimum of finishing when released from the mold. Machining, polishing, drilling, tapping and other mechanical operations are possible on the cast part and the advantages of translucence and striations, peculiar to casting resins, become available. This also applies to the clear, transparent acrylic and styrene resins as well as to cast phenolics.

With regard to prevalent terminology, the layman needs merely to know a few of the important facts as outlined in order to gain a comprehensive idea of all the different terms being used. It is not necessary to dwell on the chemical formulas of the various materials, but more important to know the two recognized groups. Likewise it is not essential to have an intimate knowledge of the different molding processes, but rather the capability of distinguishing between the various methods as they apply to the respective products. Of course, all the numerous plastics are by no means included in this discussion but most of the common ones have been selected for this brief discussion.

RIGHT TO A "T"

(*Continued from page 28*) more accurate method is to bring the measure close to the foot, eliminating pushing and pulling, so that the back of the device is flush against the heel, allowing no distortion of measurements.

The T-Square foot measure, developed by Charles Henry Brown is based on the Heel-To-Ball fitting system which he originated. Thoroughly modern, this method employs the same accurate mathematical principle used by architects, draftsmen, carpenters and machinists for precision work. It takes into consideration depth as well as length and width. Furthermore, the T-square formation makes possible the measurement of both feet at once for comparative purposes.

The device features a heel-to-toe scale (A) for determining the proper last (short or long vamp, etc.). An adjustable toe-bar (B) registers the size on the scale through a window. A spring-tape (C) which pulls out on the widest part of the foot, takes depth into account, as well as width, all in one operation. Providing a check for measuring very small or very large feet, there is a sliding ball-socket (D), the forward ridge of which is designed to settle on the actual articulation of the joint. The cross-bar or back-stop (E) forms a rest for the extreme back of the heel. The completed unit, (illustrated on page 28) properly operated, gives overall dimensions and the circumference of the foot.

Tactile quality was an important factor in selecting the material for the device. It had to be smooth to avoid tearing hose, injuring customer and feel neither cold nor hot to the touch. Color harmony with smart interiors—polished finish so that it would not mar furniture—an inconspicuous, smart apparatus made to hang within convenient reach of the fitter—were additional requirements along with retailer's demand for a serviceable, inexpensive, easily manipulated shoe guide. Molded phenolic was selected because its lightweight, strength, resistance to temperature changes and economy of molding allowed best execution of mechanical requirements and its colorful, rich, lustrous finish provides the all-important decorative note.

There are seven molded plastic parts shown, all fitting so perfectly that only three screws are required to fasten the various members. Two long plastic shafts, forming the trunk, fit into a brace or fillet which is part of the molded base. A molded socket, at the opposite end, screws on, holding the entire assembly together,

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and the molded base strengthens the device and insures accuracy of the right angle, since the cross-bar stands up high enough to meet the extreme back of the foot. The trunk is hollow in order to house the sliding members. Therefore, it is very light. Curved to fit the foot closely, the sides of the shafts avoid hard surface contacts—there are no sharp corners to dig into flesh or furniture. Both the toe-bar and ball-socket, which fit into the shaft, slide easily but do not move independently of their own weight once they are in position. The ball-socket, cupped on both sides to settle definitely on the ball joint of the foot has a window-like opening through which the size is read. Attached to this part by a small screw is the cartridge of the spring-tape. The latter, rolled up inside a metal cylinder, (F) is covered by a tube which screws on. Metallic-threaded and protected with varnish, the tape may be easily washed and will not stretch, shrink or fray.

Letters, numbers and directions on the scale were etched in the molds so that they will endure. Constrasting colored background, to provide easy reading was been painted on and the excess wiped off.

Modernizing and mechanizing the retail shoe dealer's most important tool, the fitting stick, is in no small way due to the construction and design possibilities provided by the molded phenolic material used. Handsome, durable, and accurate in function, an excellent example of molding achievement, this practical item saves time and the customer's patience, reducing merchandise returns and complaints so that the customer, store and fitter share a mutual profit.

CLASSIFICATION AND CHEMICAL GENETICS OF ORGANIC PLASTICS

(*Continued from page 50*) Bacon from Lepsius' Kunststoff-Wegweiser 1937 and published in the News Edition of Industrial and Engineering Chemistry, Vol. 15, pages 411–417, September 20, 1937 (American Chem. Soc., Washington, D. C.).

The trade names of plastics currently marketed in this country are listed in a "Directory of Trade Names" published on pages 297–8 of the October 1938 issue of the trade journal "Modern Plastics." More comprehensive lists of trade names presenting those originating both in the United States and Europe and also including many no longer in use were published in Chemical and Metallurgical Engineering, Vol. 41, pages 589–596, November 1934, Vol. 44, pages 427–9, August 1937, and Vol. 44, pages 490–2, September 1937 (McGraw-Hill Publishing Company, New York City), and in the book by Carleton Ellis entitled "The Chemistry of Synthetic Resins," pages 1380–1419, published in 1935 (Reinhold Publishing Corp., New York City).

Lists of manufacturers, custom molders, fabricators, and designers of plastics are published in the October 1938 issue of Modern Plastics, pages 285–302.

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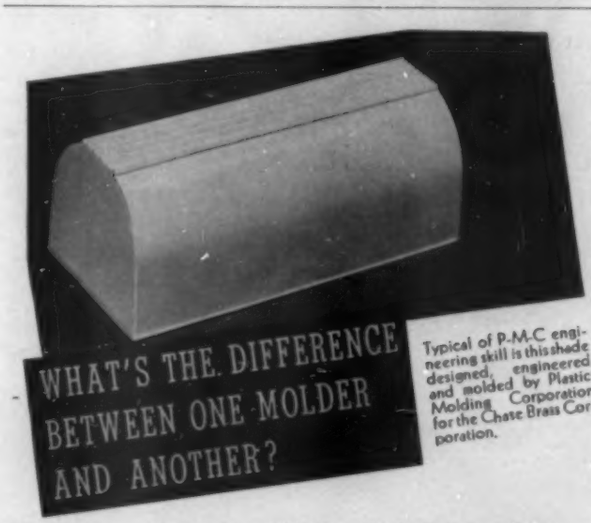

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